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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Current Issue.

Special features of this issue include a paper on the geographical distribution of cotton which was read recently by Mr. G. Evans, Director of Cotton Culture, before the Royal Geographical Society of Queensland; notes on sheep and soil by Mr. Brünnich; a survey of sugar pests and diseases in the Mackay district by Mr. Cottrell Dormer; and Mr. Froggatt's sixth progress report on the banana weevil borer. This month Mr. Shelton describes the Duroc-Jersey pig. A noticeable curtailment of some of the regular features is due to pressure on space.

A Tractor School for Farmers.

A difficulty in the way of the more general use of tractors on the farm is lack of mechanical knowledge, to which is often added a feeling of uncertainty as to one's ability to operate a tractor successfully. With horses a farmer is, of course, fully confident, but the apparent complexity of a tractor often induces a feeling that without mechanical training it would be unwise to invest good money in an expensive machine. To overcome this difficulty, the authorities of the Queensland Agricultural High School and College have arranged a tractor school for farmers, commencing on Tuesday, 24th June, and closing on 5th July. A fee of £2 10s. has been fixed for the course. This fee will cover board and lodging for the period, as well as the cost of instruction. Farmers travelling to and from the school will also have the benefit of concession railway fares. The course will comprise simple talks by experts on the economics, technicalities, and operation of tractor and farm implements and machinery with which tractors are ordinarily associated in field work. Practical demonstrations and field work will also be included. Lantern lectures on general subjects will be a feature of the evening gatherings at the school. No farmer who can possibly attend the school should miss such a unique and valuable opportunity of acquiring a sound working knowledge of modern agricultural machinery and its operation in the field.

Agricultural Ministers in Conference.

Interviewed on his return recently from Sydney, the Acting Premier and Minister for Agriculture (Hon. W. N. Gillies) said that Conferences of Ministers of Agriculture, such as the one which he had just attended, were held annually, with the exception of the years covering the duration of the war. Their principal objects are a better understanding between the various State Governments in respect to uniformity in legislation and administration on matters of common interest affecting interstate

trade in primary produce, diseases in plants, fruit, stock, border restrictions, quarantine, uniform grading and marking, export trade, and tariff protection. At the recent conference the fruit industry and dairying received special attention.

Retention of the Banana Duty.

On a question raised by New South Wales for protection on dried fruits, Mr. Gillies made out a good case for the retention of the banana duty, pointing out that the industry was worth nearly three-quarters of a million sterling annually, while it was the best closer settlement industry in the north of New South Wales and Queensland, a white man's industry in which 16,000 whites are engaged directly, and many more indirectly, whereas in Fiji the whole white population is very much fewer than the number engaged in the single Australian industry. There, black labour is employed at about 2s. 6d. per day. He also stated that, after reading Dr. Darnell-Smith's report, there was very little doubt in his mind that Bunchy Top, which had existed in Fiji for thirty years, came to Australia from those islands, and he urged this as a strong reason for the retention of the tariff. The conference, on his motion, affirmed the principle of application and maintenance of tariff protection for all commodities which are or can be produced within Australia in quantities sufficient to meet Australian requirements.

Organised Marketing.

The main question discussed by the conference, which has already received some publicity in the Press, was that on the marketing of primary products, and on this subject Mr. Gillies pointed out how necessary it is to organise the farmers before anything can be done to place them in their true economic position. He explained in full what had been done in this direction in Queensland, and indicated that although voluntary co-operation had done a lot for the dairying industry in the manufacture of dairy products, it had not been an entire success in the more important matter of marketing; and farmers are now admitting that where more than one State is concerned, legislative backing and some form of compulsion are absolutely necessary. Such legislation, continued Mr. Gillies, could only become effective if the other States and the Commonwealth followed Queensland's legislative lead. As it is, Queensland has gone as far as possible with her own legislation, and constitutional difficulties have now arisen. In respect to finance, this State has been asked to undertake what is really the duty of the Commonwealth Bank. He considered this bank should finance the primary and secondary industries of Australia, and showed that, as a result of organisation, the commercial and manufacturing interests, although they have not one-half of the security in the aggregate which the primary producers possess, they are able to get the financial assistance they need on most favourable terms, while farmers, acting individually, do not enjoy the same facilities. Large sums are not required for the marketing of primary products, but complete organisation and control will largely solve the financial problem. The success achieved by the Wheat Pool and the Sugar Board he pointedly quoted, referring particularly to the saving of £50,000 in freight alone by the latter body through their being able to speak with one voice to the shipping companies. He also referred to what had been done in New Zealand by the Massey Government in the Acts for the marketing of butter and meat. Mr. Gillies quoted the Prime Minister's (Right Hon. S. M. Bruce) speech at the opening of the recent Sydney National Show, wherein he promised to "assist primary industries, but as a condition precedent to Federal Government assistance, every industry had to thoroughly organise itself, demonstrate that it was on an efficient basis, and satisfy the Government that permanent results would be achieved." If this promise means anything, it means that farmers must be properly organised, and set up their Marketing Boards before Mr. Bruce can carry out his promise with regard to oversea markets and freight subsidies. Mr. Gillies urged the other States to follow Queensland's example, and then demand the fulfilment of Mr. Bruce's promise.

Other Important Matters.

Other matters, such as a uniform standard of examination for testers and graders of milk and cream, the testing of purebred stock, the marking of pedigreed cows for identification, the inspection of Australian dairy produce in Great Britain, investigations into the manufacture of dairy produce overseas, breaches of the Dairy Agreement by Commonwealth officials, the control and eradication of tuberculosis in stock, the establishment of a veterinary hygiene branch, and the facilitating of stock traffic between States were considered by the conference. The restrictions on the movement of cattle from Queensland to New South Wales and Victoria, and of live pigs from Queensland to Victoria, were withdrawn and left for consultation between officers of the States directly concerned. Matters relating to the wheat industry, apiculture, poultry and eggs, and the interchange of crop reports were also dealt with, as well as items regarding pure seeds, entomology, agricultural chemistry, and the necessity for the installation of thermographs in cold chambers on ships. At the conclusion of the assembly, it was decided that the next Conference of Ministers of Agriculture be held in Hobart in May, 1925.

THE GEOGRAPHICAL DISTRIBUTION OF COTTON.

PRODUCTION, MANUFACTURE, CONSUMPTION.

BY G. EVANS, C.I.E., M.A. (Cantab.), Director of Cotton Culture, Queensland, and of the Empire Cotton Growing Corporation.

Paper read before the Royal Geographical Society of Queensland, 30th April, 1924.

The serious shortage of cotton that exists throughout the world at present renders the subject of this lecture of perhaps more than passing interest. Its importance will be realised by people in Australia in general and to residents of Queensland in particular because, as you all know, strenuous efforts are now being made to establish the cotton-growing industry on a permanent basis in the Commonwealth. Queensland especially seems to be a State well suited for the cultivation of this crop.

The British Empire consumes an enormous amount of raw cotton each year, the Lancashire mills alone requiring about 3,500,000 bales, and it is a remarkable fact that we do not produce more than a fraction of the cotton that we require for our consumption. The present shortage, which is mainly due to the reduced yields of the crop in the United States of America, has emphasised this point, and has brought home to everyone in the Empire the grave danger in which we stand at the present time. Not only are our great manufacturing industries languishing on account of the scarcity of raw cotton, which we can only buy at a great price and with difficulty after the great producing countries have satisfied their own wants, but cotton is one of the most important of all war materials.

It will be seen, therefore, that of the three headings into which my lecture has been divided, that of the actual production of the raw material is by far the most important at the present time, because, if raw cotton is not made available in sufficient quantities, the manufacturing industries must necessarily be seriously affected and the consumption will be correspondingly lessened.

In this lecture, therefore, I propose to devote most of the time to the questions concerning the production of the raw material, and shall then discuss the manufacturing and consuming areas.

I shall avoid statistics as far as possible, because I know that a mass of figures generally prove uninteresting and tiresome to an audience, but will endeavour to speak in general terms and will also try to stick to the geographical aspect. It is proposed to deal with the situation first from the world standpoint and then go into more detail so far as Australia and Queensland are concerned.

The Conditions Essential for Production.

Everybody realises that cotton will not grow anywhere. Even where the climate and soil are satisfactory for the growth of the plant, certain economic factors may exist which prevent the successful cultivation of the crop on a commercial scale. The incidence of diseases and pests are also very important, since, if they are prevalent, cotton production is naturally hampered.

Climate.

The cotton plant requires considerable warmth and moisture for its satisfactory growth, and it is therefore grown only in the tropics and subtropics. About six or seven months are occupied in the growing and complete maturing of the crop. In other words, there must be a period of from 180 to 210 days between the last spring frost and the first autumn frost, because the plant is damaged by a few degrees of frost. During the growing season a mean average temperature of 65 deg. to 80 deg. is desirable, and the temperature should further be fairly uniform since the plant is sensitive to sudden changes, and checks tend to produce premature ripening. During the first two months of growth fairly cool weather and a fairly light rainfall are desirable, as the plant then develops a good root system, becomes tough and hardy, and forms the fruiting habit. A somewhat heavier rainfall and warmer weather is desirable during the middle season when the plants are putting on fruit. During the last two or three months a lower temperature and drier conditions are necessary to check vegetative growth and enable the bolls to ripen. Fine, dry weather is also essential during the picking season to enable the crop to be picked clean, since in bad weather the fibre is apt to become stained.

The rainfall most suitable for cotton varies between 25 inches to 40 inches, varying with the latitude, class of soil, &c. In some countries, such as Egypt and the

Punjab, where the rainfall is deficient, the necessary moisture is supplied by irrigation. Generally speaking, the heavier the rainfall the lighter and better drained the soil and situation must be, because water-logging is fatal to the cotton plant. Probably the highest rainfall under which cotton is actually grown as a commercial crop is in the Garo and Chittagong Hill tracts on the borders of Assam, Burma, and China. Here the rainfall during the growing period is extremely high, averaging about 90 inches, and the type of cotton grown (*G. aboreum assamica*) is probably the shortest commercial cotton in the world, the staple being very rough, harsh, and coarse, and being chiefly used for upholstering, linoleums, or packing, and not for spinning. Attempts to introduce a better quality cotton have been made from time to time but have failed, and even this poor type of cotton can only exist in this rainfall for the simple reason that the seed is planted on the steepest hillsides and thus gets complete drainage at the root.

In most of the cotton-growing countries of the world cotton is grown on a variety of soils, but speaking as a general rule the most suitable soils are always those of fair depth, and consisting of good medium loams containing a fair amount of sand and silt, along with a good natural drainage and a fair capacity for retaining moisture.

Economic Factors.

The economic factors that are of importance are the incidence of population on the land, the state of development of railways, roads, ports, and proximity to markets.

It is necessary to realise that cotton requires more labour than many other crops. A good farmer may be able to plant quite a large area, but he will require to employ extra labour at two periods during the growth of the crop. The first of these is the thinning out and chipping stage. The seed is planted in rows, and when the young plants are about 8 inches high they must be thinned out and all weeds cleaned out from between the plants. If this operation is delayed, the plants assume a wrong habit of growth and the subsequent yield is greatly reduced. To some extent the necessity for employing labour at this stage may be obviated by mechanical means, but speaking generally, the method of thinning out by hand has, up to the present, been found to be the most suitable. The second period when labour is absolutely necessary is during the picking season. The cotton plant, unlike many other commercial crops, ripens unevenly, so that unripe bolls, ripe bolls, flowers, and squares are usually found on the plant all at the same time. This necessitates going through the crop three or four times for picking. In wheat and other cereal crops the whole ripens more or less evenly, so that it can all be harvested at the one time and in one operation. This, as I have pointed out, is not the case with cotton, and although a number of machines have been invented and claims have been put forward that the problem has been solved, it is noteworthy that none have yet been adopted on a commercial scale. These machines are designed either on the suction system or on the principle of a series of bristles which entangle the ripe fibre and carry it to the picking receptacle. Without going into details it may be mentioned that the chief obstacles operating against the success of these machines are, firstly, that the grade of cotton picked is low owing to the amount of trash and leaf that is picked with the cotton, and secondly, the amount of damage that is done to immature bolls and squares by the machine during its passage through the field. It is just possible, of course, that a successful picking machine will eventually be produced, and when this has been achieved, it will mean a revolution in the cotton-growing industry, since the scarcity of labour and the high cost of hand picking is undoubtedly prohibiting the rapid introduction of cotton cultivation into several parts of the world where the conditions are otherwise favourable. It would certainly have a very important effect in Australia for the abovementioned reason, since here agricultural labour is scarce on account of the sparse population, and agricultural wages run higher than in most countries on account of the higher standard of living. If successful mechanical cotton-pickers are eventually to be introduced, however, I think it will necessitate close co-operation between the mechanical engineer and the scientific plant-breeder. The latter's aim would be to breed a compact type of plant which would mature the whole of its crop of bolls, or, at any rate, the greater part of it, more or less at the one time.

Pests and Diseases.

The cotton plant, like other highly specialised cultivated crops, is very liable to insect pests and fungus diseases. The Mexican boll weevil (*Anthonemis grandis*),

for example, has seriously reduced the yields in the United States of America. The following statement shows this very clearly:—

Five Year Period.	Average Acreage.	Average Yield in Bales.	Average Yield per Acre. lbs.
1910-1914	35,900,000	14,259,221	192·1
1919-1923	35,200,000	10,531,415	146·9

In other words the average acreage during the five post-war years is only slightly less than that of the five years immediately preceding the Great War, and yet the crop has dropped by 3,750,000 bales because the yield per acre has become much less. This decrease may be ascribed mainly to the depredations of the weevil, either directly or indirectly, although other economic factors have had some influence. The greater part of America's cotton belt is now infected, and in an attempt to outrace the pest large areas are now being planted in Virginia and Southern Illinois, where the crop has hitherto been practically unknown.

Similarly, the pink boll worm (*Platyedra gossypiella*) has caused great damage in many countries such as Egypt, India, the African Colonies, Brazil, &c., so much so that practically every cotton-growing country where the pest is known to occur has had to bring in special legislation with a view to combating this pest. Other pests and certain fungus diseases also occur and do much damage, and it is for this reason that certain areas, more particularly those within the tropical zone and with a humid climate, have found it impossible to produce cotton as a paying commercial crop. On the other hand, countries further away from the Equator, possessing a colder winter season, sometimes find that pests can be more easily controlled. Clean cultivation is an absolute factor, and it is because this point is not clearly realised by the grower that cotton-growing is so hard to establish in some of the countries where this crop is new.

The Cotton-growing Countries.

According to the International Agricultural Institute for Rome, the average area under cotton from all the countries in the world furnishing data was about 58,500,000 acres in 1921, or slightly less by 1,000,000 acres than the ante-war period. The total yield of cotton was estimated at something under 21,000,000 bales. By far the largest producer is the United States of America, with an area varying from 33,000,000 to 38,000,000 acres and an output of 10,250,000 bales in 1923-1924, or 51 per cent. of the world's total output. India comes next with about 22,000,000 acres and 5,000,000 bales. The area under cotton in China is unknown, but it is probably very large, and she produces at least 2,000,000 bales. Egypt usually has about 1,500,000 acres, and she produces round about 1,000,000 bales. This is a high yield per acre and is a testimony to the fertility of her soil, the excellence of the irrigation system, and the skill and industry of the "Fellahin." Other countries, too numerous to mention, make up the remainder, but some of the more important of them will be mentioned later.

A glance at the map indicates that the areas under cotton cultivation are mainly subtropical, and not tropical as is so often supposed. In only a few instances do these areas extend beyond the 40 deg. parallel north (China, Korea, Turkestan), and only in South Africa and in New South Wales and on the Murray in Australia do they approach below the thirtieth degree in the Southern Hemisphere.

The subtropical areas produce practically the whole extent of the crops in the United States, Russia, Asia, and China, with portions of the Mexican, Indian, Persian, and Egyptian areas, as well as South Africa and Australia; also the limited areas along the Mediterranean, Cyprus, Malta, &c.

Within the tropics are found the West Indies, Peru, Brazil, Tanganyika, Uganda, Sudan, and the West African colonies; the peninsular of Queensland, Cambodia, and the West Indies, &c. It is worth of note that by far the greater part of the cotton is grown in the Northern Hemisphere, and that the great cotton-producing areas are those in which not only is the climate suitable, but also in which agricultural labour is plentiful and has, up to recent years, been comparatively cheap—India, China, and Egypt are instances. The United States of America has also achieved her prominence as the leading cotton-producing country in the world, owing partly to her abundant and efficient labour. Brazil is rapidly forging ahead as a great cotton country, and is solving her labour scarcity and filling up her vacant spaces by an influx of immigrants. Before the war these mostly came from Central and Southern Europe, but

during the last few years the tide of Japanese immigration has set in very strongly, and thousands are now entering each year from that country and engaging to a great extent in the cotton-growing industry.

The lands south of the equator are not nearly so closely populated or highly developed as those north of the line, but it seems likely that the present century will see this state of affairs changed and that they will produce a bigger proportion of the world's crop in the near future.

Let us now turn briefly to Russia's cotton-growing area in Turkestan. This area affords a sad illustration of the extent to which a large agricultural industry can be ruined by the calamity of war or a political revolution. Russian Turkestan, as has been mentioned before, is the furthest north of all the important cotton tracts. The country is practically rainless and is surrounded by desert, and is dependent largely on irrigation. The climate is very cold in the winter, but the summer, although comparatively short, is extremely hot. Early maturing varieties of cotton are successfully grown under these conditions, and the cold winter keeps down the yests, minor damage being only occasionally caused by flights of locusts. With the outbreak of the Russian Revolution the whole industry became upset, the growers left or were unable to cultivate, and the canals fell into disrepair, so that Russia, which in 1913-14 produced nearly a million bales, is only estimated to produce 180,000 bales in the coming season.

This potentially great area is bound to recuperate in time, however, and again take her place as on eof the big cotton-producers of the world.

Cotton-Growing Areas in Australia.

I have gone into some detail in discussing this somewhat remote area because it seems possible that the climatic conditions there are somewhat similar to those of certain parts of Australia, where thoughtful people are now considering the possibilities of introducing cotton-growing. The particular areas meant are in the dryer areas of this continent, along the Murray and Murrumbidgee Rivers. Here cotton, if it can be grown, will have to be irrigated. The winters are cold and the growing season is short, but the summer, like that of Turkestan, is hot owing to its proximity to the enormous arid interior of this continent. There would seem to be no reason why cotton should not grow and yield well in these areas provided an early maturing variety of the right type is cultivated. In this connection it is probable that a close investigation into the methods of cultivation employed and the types of cotton used in far-away Turkestan, where cotton-growing has already proved a pronounced commercial success, would be amply worth while. This is the only part of Australia where cotton is likely to be grown under irrigation just now, although it is possible that when the irrigation schemes that are now maturing in Queensland, west of the Main Range, begin to function, it may pay to grow cotton with the help of irrigation water.

Northern Territory and the Nor' West.—The main crop of this country will, however, be rain fed and not irrigated. Apart from Queensland, which is the main cotton-producing area, and which we shall again refer to presently, this crop has been successfully experimented with in parts of New South Wales and the Northern Territory, and is also being tried in the North-west of Western Australia. In these two latter areas it is noteworthy that the summer temperatures are high and that the rainfall mainly falls during the growing period of the crop. An interesting illustration of this necessary correlation of rainfall and temperature is shown by a reference to the rainfall statistics of Western Australia. In the southern portion, as far up the coast as Geraldton, the rainfall falls almost entirely during the winter months, with the result that the main crops are the cereals of the temperate zone—viz., wheat, oats, &c. In the middle belt, although the summer is hot, the total rainfall is very light and is not sufficient for the cultivation of any crop except under irrigation, which is not at present available. The whole of this vast area is therefore pastoral, and is one of the most important wool-raising tracts in the world. In the neighbourhood of Broome, however, monsoonal influences begin to appear, and from thence northwords the country has a summer rainfall which is said to be as much as 70 inches in the neighbourhood of King George IV. Sound. At Derby, the rainfall is over 30 inches, but the amount of land available for cotton does not at present seem to be very large, although the Western Australian Department of Agriculture may eventually discover a suitable area within reasonable distance of a port. It must be remembered that the greater part of this country has never been properly surveyed from an agricultural point of view. The highlands consist of light sandy red soils, which have no subsoil and are consequently liable to dry out very quickly and to become extremely hot on the surface. The alluvial flats along the river valleys are, on the other hand, subject to inundation and are therefore unsuitable for cotton. There are indications, however, that in the

valley of the Drysdale River and in the country between Wyndham and Hall's Creek the climate and rainfall are both suited, and that large areas of suitable soil also occur. The prohibiting factors at present are the lack of population and the lack of communication and facilities for getting the crop down to port, and so to the markets. Similarly, in the Northern Territory the rainfall is monsoonal, falling entirely in the summer months. There is remarkably little land within 200 miles of the coast that is suitable for cotton. The land between the valleys consists of thin soils overlying clay pan, and the chief features are pandanus palm, which usually indicates a water-logged soil, and the enormous anthills, which are generally taken as showing that the soil is hungry. The alluvial flats along the big rivers, such as the Daly and the Adelaide, are extensive in the lower reaches, but are liable to flooding and, from what little I was able to see of them, would be best suited to the cultivation of wet rice or jute. Both these crops require a dense population to be successfully dealt with, and, as we all know, this is not forthcoming at present. I am not a sufficiently good geologist to hazard a statement, but it seems just possible that the whole of the north coast of the continent is gradually sinking. If this is so, it would account for the reason why all the alluvial flats and river valleys are so liable to inundation. In the upper reaches of these rivers, along the coastal belt of the Northern Territory, the alluvial lands are narrow and somewhat infrequent, and the rainfall is likely to prove somewhat too heavy and continuous for cotton. I did not, in fact, come across any really large body of land suitable for cotton cultivation until I got to the Roper River, some 300 miles south of the coast, although a few patches of fair land occur along the Katharine River and some of the creeks. In the Upper Roper Valley, however, it should be possible to grow excellent cotton, given the necessary agricultural population and facilities for marketing and handling the crop. The land consists of large areas of sandy to medium alluvial loams situated above flood level, and the rainfall is not too heavy, but is regular and consistent, averaging about 32 inches, all of which fall in the growing period. The picking season has fine weather, and it should be possible to keep the pests in check by means of burning the old stubble and rubbish at the end of the dry season. The new extension of the railway from Katharine to the Daly Waters will open up this country and solve the difficulty of handling the crop. The progress of cotton-growing in these areas will, however, depend entirely on the success that attends any scheme for settling an agricultural population on the land. The aboriginal population is fairly thick, and I personally think that, if treated properly, they can be relied on to give a good deal of casual labour in the initial stages. The few settlers who are attempting to cultivate the land at present in these parts are employing the aboriginals for clearing the land, weeding and thinning the crop, and also for picking. Although not, of course, adepts, the work I saw them doing was quite satisfactory, considering that most of them have never been engaged in agricultural operations before. Many of these people are of fine physique, and are certainly not devoid of intelligence, and for casual labour, such as is required during the picking season and for thinning, I have no doubt they will prove of great assistance to the pioneer farmer in these parts. Whether any large influx of settlers will be attracted to these parts I cannot say, but I should imagine that the less remote parts of Australia will be occupied first.

New South Wales.—Turning now to New South Wales, we find that considerable attention is being paid to cotton in the valleys flowing east from the Main Range to as far south as Sydney. Both rainfall and summer temperatures are suitable for the growth of cotton in these parts. On the coast itself and at the mouths of the rivers flowing into the sea it is possible that the rainfall may prove too heavy and the atmosphere too humid in the autumn during the picking season. Fifteen or twenty miles inland, however, these conditions disappear, and the result is that cotton of the finest quality has been grown on the middle and upper reaches of the Richmond, Clarence, and Hunter Rivers. On the upper reaches, when the rainfall averages 26 inches to 32 inches, the most suitable soils would appear to be the sandy alluvial flats, which cover large areas along these valleys.

On the west side of the Main Range experiments are being carried out, and it seems probable that this valuable money crop may be introduced in parts of the north-western and central-western slopes, where the necessary summer rainfall occurs. Both these areas have a somewhat short season, however, and it is possible that early ripening varieties will give the best results.

Queensland.—Turning now to Queensland, we find that the temperature is everywhere suitable for the commercial cultivation of the crop except on the higher elevations at the top of the Main Range, in such localities as Stanthorpe, which is probably too cold. In Queensland the rainfall is the limiting factor. The rainfall map of the State indicates that the incidence of rain over an average of years is curiously uneven. We have wet belts, such as the Tweed, Nambour, Bundaberg, Proserpine, and Mackay, and further north at Innisfail and the Cairns country, in which the rainfall is probably too heavy over a series of years to suit cotton. In

one or two of these areas, where the rainfall is not much more than 40 inches, it is possible that cotton may grow well on the lighter soils and in well-drained situations. Generally speaking, however, the plant is inclined to put on too much wood in these tracts, and attacks of diseases and pests are more prevalent. Some of these diseases are indirectly encouraged by the humid atmosphere. Thus an internal boll-rot disease, which is prevalent on the coast, is caused by certain sucking bugs and grubs, which puncture the boll and incidentally let in the spores of a certain fungus which could not otherwise gain entrance. This fungus then sets up a rot and destroys the young cotton, and is causing damage chiefly in the coastal belt.

Speaking generally, therefore, we find that the conditions which are most favourable to the production of a commercially paying crop exist in a belt of varying width between the New South Wales border and Mackay. The average rainfall in this belt varies from 25 to 40 inches or so, and the area of land comprised in this cotton belt amounts to many millions of acres.

It is necessary to point out that the whole is not culturable, however, as the area I have indicated is extraordinarily broken up into narrow valleys and plateaux, with large areas of rocky ranges and ridges covered with indifferent and shallow soils which are only useful for light grazing. Nevertheless, the total area of good cotton land that is available for development is very large, and when we remember that other large areas occur north of Mackay, which have not yet received much attention from a cotton point of view, I think you will agree that we have in Queensland one of the few large untapped potential cotton-growing areas remaining in the world.

The soils in this area are extraordinarily mixed; in fact, to a person accustomed to large cotton-growing countries in other parts of the world, this fact is very forcibly driven home. In India, we find thousands of square miles of black cotton soil in the Deccan and Berar, and the same occurs in Texas, whilst in Egypt and Mesopotamia one is dealing all the time with an alluvial soil. In the Queensland cotton belt, with rare exceptions, this is not the case. You may be standing on a deep black clay valley bottom which merges on the slopes into a chocolate loam covered with silver-leaf ironbark trees. Within rifle shot in one direction you may see cotton growing on a light red powdery volcanic soil of great depth and famous for its prolific maize and fodder crops, whilst at an equal distance in another direction one may drop down into a shallow valley and admire some extensive alluvial flats of splendid sandy loam in which the typical tree is the Moreton Bay ash, a sure sign, as a rule, of a first-class cotton soil. Again, a few miles further on, the eternal gums of the Australian forest may give place to a different flora, and we may find ourselves in a thick scrub of deciduous bushes and trees, prominent among which is the well-known bottle tree. This, however, is not a treatise on ecology, and enough has been said to indicate the extraordinary variety of the soils and the intricate way in which they occur. Experience is beginning to teach us that all these soils are not equally suited to cotton, and that year in and year out certain types are more satisfactory than others. Farmers in the South-east and the Maranoa now realise to a great extent that the medium and sandy loams are the most suited, one of the reasons being that, if properly cultivated, they retain moisture well, and an early plant, which is essential for the greatest success, can then be obtained. The heavy black soil may give good results in certain years, but is more difficult to work up into a seed bed and is hard to keep free of weeds during the rainy period.

The boom period of cotton is now passing and we are all getting down to hard facts, and one of these is that cotton, if a good paying crop is to be obtained, must be farmed properly, just as any other crop is; slipshod cultivation is fatal. It is also beginning to be realised that it has its own requirements regarding class of soil, methods of cultivation, &c. It will have its ups and downs such as any other crop will have in a climate such as Queensland's, where the rainfall is not entirely dependable, but it is now believed that cotton, if properly farmed, is more likely to give a crop during a semi-drought period than any other commercial crop. It also has the further advantage that its price is not dependent on the local market, and is not, therefore, subject to sudden and distressing drops owing to over-production. Cotton is a world commodity, and we all believe that the shortage of raw cotton is such that the price is not likely to drop for a good long time.

With regard to pests we have our troubles since they have proved destructive in some parts this year. Pests, however, are generally bad after a drought, and cotton, it must be remembered, was not the only crop attacked. Other countries have, however, the same pests that we have, and by the adoption of sound precautionary and remedial measures (of which the most important are clean farming and a "dead" season) have continued to keep them in check. It is difficult to believe that the Queensland farmer cannot do the same. Finally, we must remember that we have not got the boll weevil, which, perhaps, is the most destructive of all cotton pests and the most difficult to combat.

Having discussed briefly these factors in the successful production of cotton in this State, we now turn to one of the most important factors of all—namely, that of population. Owing to the scarcity of population it is unlikely that cotton will be grown in Queensland to any extent on the plantation system. The tendency is for a farmer to put in a few acres of cotton along with his other crops. In other words, he goes in for mixed farming, thereby planting and cultivating as much cotton as he, with the help of his family and a few friends, can pick. By so doing he nets a return which helps to materially swell his credit balance at the end of the year. The tendency is all in this direction this year, and is shown by the fact that we have about 60,000 acres under the crop grown by about 8,000 or 9,000 farmers. This area, in a normal season, would be expected to yield about 20,000 bales, with, let us say, at the current prices, a value of about £700,000. Let us presume that there are an equal number of farmers who farm land in the cotton belt who are not yet growing cotton. Should they take up cotton-growing we might possibly get double this output, or if the season were exceptional even 50,000 bales. That would be somewhat about our limit at present, and we cannot hope to get much more unless land is taken up for cultivation inside the cotton belt much more quickly than is happening at present.

When we realise that the world's shortage of cotton is about 3,000,000 bales, it will be seen that Queensland's possible contribution towards meeting the deficiency is a somewhat modest one at present, although the potentialities undoubtedly exist.

MANUFACTURE AND CONSUMPTION.

Cotton a Comparatively Recent Commercial Product.

It is not generally known that cotton has sprung into importance comparatively recently, and it is difficult to realise that a little more than 200 years ago cotton was practically unknown to civilised western nations. It was, of course, known before that in the East, but was not so important as other fibres, and the Sanskrit word "Karpasia" originally meant flax and not cotton. Herodotus, in 450 B.C., refers to a cotton material, but this is probably the kapok (*Bombax malabaricum*), the silk cotton tree which is so common in the East Indies. By the beginning of the Christian Era, however, Indian cotton is first mentioned in the commercial circles, and the painted calicos of Masalipatam and the famous muslins of Dacca were beginning to be well known.

It is only in the last century and a-half, however, that cotton has come into its own. In 1784 the British Government seized eight bags of cotton imported from the United States of America, on the ground that no such large quantity of cotton could have been produced in that country. To-day it is estimated that the world's total consumption of cotton would, if the purchasing powers of the people were normal, be in excess of 22,000,000 bales of 500 lb. net (lint).

The Reason for its Rise in Importance.

The first cause of this tremendous increase was the introduction of textile machinery. The spinning jenny was invented by Hargreaves, in Lancashire, in 1764, and since then continual improvements have been made until the modern textile machinery has been evolved. The introduction of machinery enabled fibres to be made up into fabrics at a greatly reduced cost, and therefore a greater demand arose, necessitating the use of a cheap fibre. The advantages hitherto enjoyed by cotton have been a relative abundance of supplies and a low price as compared with other fabrics of a similar nature, such as silk, flax, and even hemp and jute. The two former in particular were not only more exacting in their requirements, but were more expensive to produce.

About fifty years ago cotton was chiefly used for wearing apparel, and apart from sail cloths, tents, &c., the demands for it from other branches of industry were negligible. Production was, therefore, limited to the purchasing power of people for clothes.

Within the last forty years, however, the use of cotton has extended far beyond that of producing clothes for the peoples of the world. The price depression in the "nineties" caused cotton to become so abundant and cheap that it began to be used as a substitute to replace other products. Trials in this direction indicated that cotton was not only cheaper but was often more satisfactory than the original product, and further experiments resulted in still further uses being made of it, so that in many industries it has now become an essential for which no substitute can at present be found.

New Uses for Cotton.

A few examples of these new uses may prove interesting. With the rising price of leather it was found that heavy duck or rubber with a basis of cotton proved an efficient substitute for belting, and thousands of bales of cotton were required annually for this purpose. In the same way cotton bags have largely displaced wooden barrels in transporting substances such as cement, lime, &c.

Another very large consumer is represented by the railways of the world. Thousands of bales are consumed annually in the manufacture of air-brake hose, of fabrics for the seats and cushions, whether plush or artificial leather, and for enamelled ceilings, which are usually cotton cloth covered with a coating of enamel.

An industry of quite recent development is the automobile business, and this has now become the greatest single consumer of cotton and cotton goods in the United States. That country has an annual output of 2,000,000 cars or so, and it is obvious that the amount of cotton required for tyres, hoods, seats, and cushions must be enormous. One tyre manufacturing company alone is reported to use 120,000 bales or thereabouts each year, and it is evident that the time will not be far distant when 500,000 bales at least will be required for the automobile industry. Finally, there is the use of cotton as a war material. Nowadays cotton comes next in military importance to chemicals, copper, and petroleum. It provides not only clothing for the soldiers, but tents for their shelter, tarpaulins for stores, and sand bags for the trenches. It is also one of the most important essentials entering into the manufacture of high explosives. Warships use an enormous quantity of cotton for awnings, &c., and it is, of course, largely used in the construction of aircraft.

The Present Shortage.

In other words, the utilisation of cotton in so many new industries has caused a greatly increased demand within recent years which the producers of raw cotton have barely been able to meet. Following on the serious position as regards supply which was evident before the war, that great calamity resulted in an enormously increased consumption, with the result that the reserve stocks rapidly disappeared and do not now exist. There is, therefore, a great rise in prices, and extraordinary endeavours are being made in many parts of the world to grow more cotton. The present shortage is somewhere about 3,000,000 bales, and it will probably take many years of strenuous endeavour to make the supply approximate again to the demand. There seems to be no prospect of any material drop in the prices for some time to come in the existing circumstances.

The Consuming Countries.

In the old days cotton was mostly grown in the East, and was there made up into cloth on hand looms. In those times piece goods were actually imported into Europe by the Western nations. With the invention of textile machinery towards the end of the eighteenth century, however, industrial centres arose in Lancashire and other parts of Europe, and a rapid change in trade relations resulted. The better educated and more industrially efficient Western nations found that they could afford to import raw cotton from the growing countries, and by reason of the cheap methods of textile machinery make it up into cloth and export and sell it at a profit overseas.

The rapid rise of the United States as a cotton-growing country, coupled with the introduction of steam power into ocean-going vessels, enabled the cotton so produced to be transported cheaply and rapidly to the mills in the industrial centres of Europe, and this gave rise to the great textile industries that we know of to-day in Lancashire and other centres. The American Civil War caused a serious depression in the Lancashire cotton industry, and it is interesting to note that even in 1863, as a result of the shortage of raw cotton directly resulting from that war, there was an outcry against the continuance of dependence of the United States of America for supplies of raw cotton. With the establishment of normal conditions in the Southern States and the rapid settlement of further cotton-growing areas, however, the supplies again became large, and the Franco-German War of 1870, which seriously upset the textile industry on the Continent, further strengthened the English manufacturers.

Even at this stage, however, the tendency had arisen for the cotton-growing countries to start manufacturing their own cotton goods, and this tendency has increased rapidly within recent years, so that not only the United States of America, but other cotton-producing countries, such as India, China, Brazil, and Egypt, are now making up large quantities of their raw product. The following figures are instructive and illustrate this point:—

Estimated Number of Spindles (000's Omitted).

	1880.	1900.	1920.
Great Britain	41,000	42,460	58,692
United States of America	10,700	28,349	35,834
Continent of Europe	21,500	40,577	43,264
India	1,700	5,657	6,689
Japan	..	3,690	3,690
China	..	..	1,600

This table shows clearly that the United States of America, India, and China are all now manufacturing their cotton and that less therefore is available for the manufacturing, but non-cotton-producing countries, such as the European countries and Japan.

The United States of America mills were, until comparatively recently, mostly located in the northern States outside the cotton belt, but there has been a tendency of late to erect mills on the spot where the cotton is produced. Probably the idea is that in lean years these mills will be in a better position to secure supplies of cotton. Possibly, also, labour conditions may be easier. In any case it is a remarkable fact that whereas in 1860 Southern State mills only consumed 178,000 bales; in 1921 they purchased nearly 3,000,000 bales.

The proximity to supplies is not, however, the only factor that tends to favour the establishment of cotton manufacturing mills. The nearness and extent of the markets has also to be taken into consideration, and the standard of technical skill and the capability of hard, honest, and intelligent work that the inhabitants are capable of producing have to be borne in mind. In the latter respect the European countries had for many years a comparative monopoly, and were at a great advantage compared with the Oriental nations which were more behindhand in this respect. The recent rise of Japan can be instanced, however, as an example of the way in which a nation can rise successfully over obstacles of this sort. This country buys most of her cotton from India, but more recently has also been purchasing better quality fibre from America and other countries. She has made herself to learn the intricacies of the textile trade, and has a large and ready market at her door, not only at home with her large population, but in China and the other countries of the East with their teaming millions. India also has her market within herself, and not only produces the cotton, but has natural resources in the shape of coal and cheap labour. Her industrial education has been less rapid, however, and her progress has not therefore been so phenomenal as Japan.

The United States of America appears to be the best situated of all nations for cotton manufactures. She has a large internal consumption which requires cotton, not only for clothing fabrics, but also for many other highly organised industries, and she has an intelligent and skilled industrial population, great material resources in the shape of oil, coal, and water, and, in addition, produces the bulk of the world's cotton. Many people believe that in a few years' time the United States will consume all the cotton she produces, and that there will be little left for export. Compared with the States, Europe seems to be badly situated in that she produces practically no cotton and has to import all of it from overseas, often from a considerable distance. It must be remembered, however, that she has a large market right at her doors, and a market that in normal times can pay well and requires the finest materials. Further, her cotton manufacturing industries are highly specialised, and the workers have an apparently hereditary skill in their work. The machinery used is up to date, coal is abundant, climatic conditions are particularly favourable, and the markets are well organised and established. The tendency for Lancashire in particular is to concentrate on the manufacture of high-class goods, which some of the other countries new to the industry cannot at present emulate.

One of these days it is possible that Australia will manufacture cotton goods, but the most important work she has before her just now is to produce more cotton. Queensland's cotton output last season was 7,736 bales only. A modern spinning mill will consume somewhere about 40,000 bales in a year, and owing to our distance from other cotton-growing centres, it is doubtful whether it would pay to import in large quantities. Moreover, our population is small, and the internal market is therefore necessarily limited, and since the costs of producing manufactured articles in this country are high, it is doubtful whether it would pay to export at present rates.

With an increased population and more people growing cotton, however, it would seem that some time in the future Australia will naturally take to manufacturing her own cotton goods.

SHEEP AND SOIL.

By J. C. BRÜNNICH, Agricultural Chemist.

The question has been raised—"What influence has the geology of a district on sheep breeding and wool production?" Geology unquestionably has an important connection with the soil, its composition and its fertility, as the soil is generally formed from the rocks found underneath and in the neighbourhood. Our practical sheepmen know from experience that limestone country is desirable for breeding of stud sheep; on soils of granitic origin, containing always a high percentage of potash, a particularly high-grade wool is produced; and that other districts with soil richer in humus and other mineral salts, and renowned for their excellent pasture, are particularly suitable for fattening.

Granting the influence of geology as a factor in sheep raising, it is very questionable if the recommended exhaustive geological survey of the whole State, which would involve an enormous expense and take some considerable time, would be of particular advantage to our pastoralists. Most of our large holdings have been chosen without any consideration of the geological aspect, and the fact remains that Queensland holds the proud position amongst all the Australian States to produce the highest class of wool. Even now, if one of our successful graziers should wish to take up a new lease, he would consider the soil, grass and herbage, climate and rainfall, accessibility, &c., without a study of a geological map.

A geological map may be frequently misleading when used to judge the soil, as the rocks below the surface are not always a true indication of the quality of the soil. For example, a soil may be very deficient in lime, although actually overlaying good limestone deposits. Only deeper-rooted trees and shrubs give a good indication of the geological strata, but not the shallow-rooted grasses.

The actual amounts of mineral plant foods removed from the soil by sheep are exceedingly small on our lightly stocked country, as will be seen from figures given below.

According to Lawes and Gilbert, of the Rothamsted Experiment Station, the following table gives the composition of the entire bodies (fatted weight) of sheep:—

——	Water.	Fat.	Nitrogenous Matter.	Ash.	Stomach and Intestines Content.
	Per cent. in entire body.				
Fat lamb	47·8	28·5	12·3	2·94	8·54
Store sheep	57·3	18·7	14·8	3·16	6·00
Half-fat sheep	50·2	23·5	14·0	3·17	9·05
Fat sheep	43·4	35·6	12·2	2·81	6·02
Extra fat sheep	35·2	45·8	10·9	2·90	5·18

The ash (2.9 per cent.) of a sheep contains—

Potash, K_2O.	Soda, Na_2O.	Lime, CaO.	Magnesia, MgO.	Phosphoric Acid, P_2O_5.	Silica. SiO_2.
Per cent. ·14	Per cent. ·13	Per cent. 1·19	Per cent. ·04	Per cent. 1·13	Per cent. ·02

Of 100 lb. of food consumed by a sheep, only 4 lb. are utilised to maintain life weight and to grow wool, and 96 lb. are voided as manure and lost by perspiration, &c.

It will be noted that the greatest variation in the composition is shown in the percentage of water and fat, whereas the nitrogenous matters and the ash show but slight change. The amounts of mineral matters are extremely small and consist chiefly of lime phosphate, but, although small, these constituents are of utmost importance, as they form the foundation of the whole structure and play important parts in the metabolic processes, and want or shortage of any of these mineral constituents in the food will quickly affect the health of the animal and its future development.

In order to form some idea what the sheep really take from the ground, we will assume an area of 100 acres on which 100 merino sheep, of an average life weight of 100 lb. each, are pastured, and giving an annual wool clip of 800 lb.

As a matter of fact, only the constituents contained in the wool clip are removed from the soil, and, of course, such constituents contained in the sheep which are sold, but for the present calculation we combine the constituents contained in carcass and wool. We find—

——	Nitrogen.	Potash.	Phosphoric Acid.	Lime.
	Lb.	Lb.	Lb.	Lb.
100 sheep at 100 lb. contains	237	17·4	119	132
800 lb. of wool contains	43	45	0·7	1·5
Total in sheep and wool	280	62·4	119·7	133·5
or per acre	2·8	0·6	1·2	1·3
One sheep will supply daily 2·3 lb. fæces and 1·1 lb. urine containing annually per acre	4 to 12	4 to 13	2 to 4	7 to 16

An average rainfall of 28 inches will supply per acre 3.7 lb. of nitrogen.

A soil (Maranoa district) contains per acre to a depth of 12 inches—

——	Nitrogen.	Potash.	Phosphoric Acid.	Lime.
	Lb.	Lb.	Lb.	Lb.
Total	2,511	20,373	4,536	50,310
Readily available		474	226	

By taking this typical grazing soil from the Maranoa district, we find that according to the analysis we have a supply of mineral constituents which will last for thousands of years when used for grazing sheep at the rate of one sheep per acre.

A careful study of the above figures will show that the amount of nitrogen in the soil will easily hold its own; that the rainfall alone will supply more than the sheep can remove, and, in addition, there will be a considerabe accumulation of nitrogen by the growth of leguminous herbs, shrubs, and trees.

Wool removes a considerable amount of potash, but the biggest drain on the soil is made on phosphoric acid and lime. The sheep itself returns to the soil a very large amount of plant foods in the form of liquid and solid manure, and over 90 per cent. of all these plant foods taken originally by the grass and herbs from the soil are returned in the manure in a more readily available form for future crops.

Periods of drought, occurring from time to time in Australia, are nature's "fallow," and will lead to a continual accumulation of readily available plant foods, which account for the phenomenal growth of grass and herbage after the first good fall of rain.

Mature grasses and herbs contain comparatively less nutrient matters than the first young growth, more particularly with regard to mineral and nitrogenous matters, and this accounts for sheep doing so much better on young, short grass. When the growth of grass is very luxuriant, sheep may get their required amount of food in much shorter time, but it may be deficient in mineral matters, and lambs especially would suffer by getting an over-rich milk, deficient in mineral matters.

The amount of phosphoric acid in our soils is generally low, and it is therefore quite possible that in the surface soil the phosphoric acid may become depleted, and therefore yielding grasses deficient in this important constituent.

The instinct possessed by all animals drives them to lick soil, chew bones, &c., to satisfy a craving for mineral matters, and for this reason licks have been found beneficial all over the world.

The best and most natural method of supplying phosphoric acid and lime is by top-dressing of the pasture with phosphatic manures and dressings, in accordance

with the composition of the soil, with either of the following fertilisers:—Bonemeal, Thomas phosphate, Nauru phosphate, Nauru phosphate and superphosphate mixed, partially dissolved Nauru phosphate, and meatworks fertiliser can be applied. Such manuring becomes an absolute necessity in heavily stocked countries, and is largely practised in many places with great success. Unfortunately, an extensive use of phosphates as a top-dressing of our pastures is out of the question, but every sheep-owner could have a small paddock top-dressed and used as a nursery paddock for ailing sheep. Anyone who has seen top-dressed pasture and the way in which stock rush the manured grasses in preference to natural unmanured grasses will become convinced of the value of top-dressing.

In many districts, however, a supply of licks containing lime phosphate has made unthrifty pasture valuable and able to produce normal healthy stock.

Salt has been used as a lick for stock generally since time immemorial, because salt in small amounts acts as a tonic and helps in the digestion of food and keeps sheep, more particularly, in a healthy condition.

Phosphoric acid and lime can be supplied in the form of sterilised bonemeal, and can be mixed in equal portions with the coarse salt. An excellent and much cheaper substitute for bonemeal is found in finely crushed Nauru or Ocean Island phosphate, which contains about 38 per cent. of phosphoric acid and 60 per cent. of lime, and is just as soluble as bonemeal in weak organic acids.

Addition of other medicaments in very small amounts, like sulphate of iron, iron carbonate, gentian, ferrugreek, &c., may give in some cases beneficial results.

The erroneous opinion has been expressed by a few that prevalency of the stomach worm (*Strongylus contortus*) has something to do with the soil, and that the composition of the soil is the cause of "wormy districts."

In conclusion, the following well-known facts may be here emphasised:—

(1) No country is naturally wormy, but any district may become worm-infested by allowing any ruminant, having stomach worms, to graze on clean country.

(2) It is absolutely futile to expect to cure sheep of stomach worms by giving them licks, or supplying lime in form of limy drinking water.

(3) Licks can only improve the health of sheep and supply any deficiency of mineral constituents lacking in the natural food supply. Healthy sheep will be able to withstand attacks of stomach worms and blowflies better than weakly or sick sheep.

(4) In order to build up normal healthy constitutions, lambs must be supplied with foods containing a sufficient amount of lime phosphate, and if deficiency of these constituents is suspected in the pasture, should get access to licks made of a mixture of lime phosphate and salt.

CANE PEST COMBAT AND CONTROL.

Mr. Edmund Jarvis, Entomologist to the Bureau of Sugar Experiment Stations, reports to the Director (Mr. H. T. Easterby) under date 28th April:—

Breeding Digger-wasp Parasites.

The work of breeding additional specimens of our scoliid wasps of the genus Campsomeris for introduction into Java has been continued during the present month, capture of these useful parasites and subsequent rearing of same in our laboratory from the egg to cocoon condition having been entrusted to Assistant H. Knust.

Digger-wasps were scarce in canefields throughout February, which was a dry month, but following on a fall of 5.62 inches of rain (from 3rd to 9th March) they emerged freely, and on the 10th of that month twenty-two female wasps were captured without any difficulty in about an hour. These were induced to oviposit regularly each day, so that early in April we were able to send a consignment of cocoons and larvæ to Professor Leefmans at Buitenzorg.

The present season happens to be particularly favourable for this class of control work, as grubs of *Lepidiota frenchi*, which are now in the third instar and form one

of the favourite hosts of *Campsomeris*, are available this year for such purpose during January and February, while those of *albohirtum* are procurable as usual later on in March to May.

Various original methods of packing these parasites were tried, with the object of reducing risk of injury during transit to a minimum. The consignment forwarded to Java this month consisted of sixty-five specimens, including intro-cocoon, larval, pre-pupal and pupal stages of digger-wasps of the genus *Campsomeris*.

Notes on the Economic Value of Parasites.

Our growers have long believed that the introduction into Queensland of some parasitic enemy of the grey-back cockchafer would afford a ready means of solving the cane-grub problem.

It should be remembered, however, that past experience has shown that this attractive phase of natural control has succeeded best when employed against insect pests which have accidentally obtained entrance into various countries, in which, being unchecked by their usual parasitic and other enemies, they have naturally been able to increase and multiply abnormally. It stands to reason, therefore, that control of such destructive species could most likely be effected in many cases merely by the introduction of those insect enemies which, in their own country, have always limited their activities.

The utilisation of parasites in this way dates back to about 1842, although perhaps the first notable success in recent times was achieved in 1889 by the introduction from Australia into California of a small lady-bird beetle (*Novius cardinalis*) to control our so-called "Cottony Cushion Scale" (*Icerya purchasi* Mask.), which, having found its way into the latter country, was working terrible havoc in the citrus orchards, defying all attempts at artificial control.

Nearly 11,000 specimens of these useful little beetles were reported as having been bred from specimens first obtained from Australia by the Department of Agriculture, and ultimately liberated in more than 200 affected orchards in California, where they cleaned up the citrus trees so effectively that in less than twelve months this formidable scale-insect was held in complete subjection.

Similar useful work was performed also by this lady-bird beetle in New Zealand, and later in Portugal, where the "Cottony Cushion Scale" had found an entrance and was fast ruining the orange groves.

Taking an instance of our own work in this connection, it may be mentioned that the well-known tachinid fly parasite, which is a natural enemy of the weevil-borer of sugar-cane in New Guinea, is at present being bred in considerable numbers by our Bureau of Sugar Experiment Stations and liberated amongst borer-affected cane in various North Queensland sugar-growing districts. Results derived from such liberations bid fair to prove highly satisfactory, this parasite of the borer having already been successfully established in many centres (see this report under separate heading below).

With regard to the possibilities of useful control work being achieved by parasites introduced into Queensland in expectation of their attacking grubs of indigenous species of cane-beetles, any success in this direction would necessarily depend mainly on the degree of relationship between the two species concerned, and incidentally on other natural factors too numerous to touch on in a monthly report.

Briefly, we know that many leaf-eating insects, when removed from their natural habitat, are nevertheless able to acquire new habits, and that a species, in order to persist and multiply, will strive to adapt itself to an unfamiliar dietary. Similarly, parasitic-insects, when unable to find their accustomed host, would for the same reason be compelled to accept the most fitting substitute that chanced to offer.

Such adaptability is, indeed, by no means rare among highly organised hymenopterous insects like digger-wasps, ichneumons, &c.

Tenacity of Life in Cane Grubs.

Laboratory experiments were carried out this month in order to determine how long a third-stage grub of *albohirtum* (grey-back) could remain alive under water during such conditions as might arise when low-lying river flats become completely submerged at flood time.

Full-sized grubs were placed singly in test tubes containing rain water, in which, after struggling a few seconds, they sank to the bottom.

About an hour later all motion had ceased, and they lay in doubled-up position with legs widely extended.

Grubs taken out of the water after intervals of 5½, 26, and 32 hours' submergence, ultimately recovered, while those subjected to 40 hours' immersion did not revive.

In a second experiment, grubs were found to survive a submergence of 41 hours; but others, although regaining slight movement, after 47 hours in the water did not live more than three days.

Again, others subjected to 66 hours continued motionless for a time and then commenced to decompose.

When first taken from the water all grubs felt cold and stiff, the body, however, regaining its usual flaccidity after an hour or so in moist soil.

Breeding Tachinid Parasites of Borer.

This branch of activity is being continued from month to month, and parasites are emerging at present in our rearing-cages in fair numbers. Latterly, most of these specimens have been females, some of which were liberated this month at South Johnstone, while others are being retained for breeding purposes. During the cooler months liberation will mostly take the form of breeding-boxes containing sticks harbouring pupæ of this tachinid fly, from which parasites will emerge and breed naturally among borer-infested cane left by the grower for this purpose.

It is interesting to note that on a selection at Merriwinni, where these flies were released about three years ago, they are now thoroughly established; and upon visiting the place in July, 1923, and again this month (March, 1924) plenty of fly-pupæ were discovered on each occasion in standing cane affected by weevil-borer.

Once established in this way the parasite will continue to do its part, unless unthinkingly destroyed or severely checked by firing of the trash throughout the area in which it is breeding.

Cane-grub Infestation.

It is early yet to state definitely the percentage of grub-attack likely to be experienced in the Cairns district.

Up to the present the weather has favoured growth of the cane, and the formation of fresh roots to replace those bitten through on grubby areas. During February and March there have been eight intervals—varying from one to eight days—on which rain has not fallen, the precipitation for these two months having totalled 26.70 inches. In spite of such welcome conditions, however, indications of the presence of grubs are to be seen at present (15th April) on high volcanic cane lands, being very noticeable over areas on which the cane was cut after flighting of the beetles.

In some cases ratoons on such land are little more than 3 feet high, and being already quite brown and drying up are practically worthless. Evidence of the presence of grubs may be seen, too, on the Greenhill Estate.

Grubs of *albohirtum* are now in the third stage and growing rapidly. During the next three weeks (terminating about 12th May) they will continue feeding voraciously on the roots and underground basal portions of cane-sticks.

Evidence obtained last season showed that these grubs do not, as some growers suppose, travel through a canefield, or even between the rows from one line of stools to another, but are content to remain among the roots of the stool under which the eggs they were hatched from were originally deposited by the parent beetle.

After devouring the main succulent roots the third-stage grubs usually commence eating holes in the underground portion of canes, and if present in numbers the whole stick is soon bitten through or so weakened that it is blown over and falls to the ground.

By the time the grubs have finished eating the basal portion remaining in the soil, the old "set" and the remains of any cane butts of a previous crop, it is about time for them to think of pupating.

When fallen stools are hidden or covered partially by trash, canes chancing to rest directly on the surface-soil are often eaten into by grubs which have come to the top of the ground under cover of the semi-darkness. It is not unusual to find cane sticks attacked in this manner, and nearly eaten through in places.

SUGAR: FIELD REPORTS.

The Southern Field Assistant (Mr. J. C. Murray) reports under date 24th April, 1924:—

Sharon.

In this locality the cane is growing strongly, and there is every prospect of a fairly heavy harvest. Crops are, comparatively, free from disease, and a minimum of damage is being caused by insect pest or root destroying fungi. Varieties that have a good appearance are—Q.813, H.Q.285, N.G.16, N.G.15, M.1900 Seedling.

Farmers are getting satisfactory results from bone dust as a fertiliser. Growers are advised to keep a keen lookout for symptoms of Yellow Stripe (Mosaic), and eradicate suspicious looking stools of cane. Analyses of these Sharon soils show them to be low in potash. Farmers are advised to do more green manuring. By ploughing in such crops as Mauritius bean and cowpea they greatly add to the nitrogen store in the soil. In such crops as these, nodule forming bacteria draw nitrogen supplies from the atmosphere. A dressing of lime is beneficial in conjunction with green manure crops. Lime would probably be beneficial on most of the forest and alluvial soils of the Bundaberg district, though on the heavy volcanic scrub soils it does not give results.

Branyan.

The area under cane is gradually being extended. The chief difficulty is getting cane to the Bingera mill. Transport will involve a fair amount of handling, as both punting and tram haulage will be necessary. Crops are looking well, and farmers consider that sugar-growing here will pay. Most of this land has for many years been used for grazing purposes, therefore it is probable that a few years must elapse before it reaches the maximum producing capacity. Q.813 is making an excellent showing. Lime would be beneficial on these soils.

Millbank.

The farmers should take heavy crops off Millbank this season. The cane is healthy and well grown, and cultivation and farming generally are good. Here, as at Branyan, the growers are handicapped by long haulage with horse teams to Bundaberg railway station. It is suggested that water carriage to Millaquin would be much cheaper and more convenient.

Farmers are recommended to use lime and green manures on these soils, the former especially, as lime not only makes dormant plant food available, but it has a beneficial effect on root-destroying fungi. Fungus parasites appear to be more frequently met with in alluvial than in volcanic soils.

Childers.

This district should cut very heavy crops this season. Since January the rainfall has been abundant and well distributed, and the cane has responded accordingly. There are only two mills in this district now, so that it is probable an early start will have to be made to get through the crop. A number of growers have a quantity of standover which will be available for early cutting.

A certain amount of leaf disease is in evidence, principally showing in the H.Q.77, and Black Innis; M.1900 Seedling is also showing disease, although not to any marked extent. The leaf hopper is numerous this year, and may be the cause, to a certain degree, of the spread of infection. However, there is nothing definitely known as to the agent that causes the disease or how it spreads. A cane variety that is making a great showing is H.Q.285. Mr. Broadhurst has had it since about 1914, but it has never been very widely distributed in the Childers district. However, the majority of the growers now appear to be planting this variety and are pleased with the progress it is making.

Some farmers are at present having drainage difficulty. The soil is saturated, water in some instances oozing out on the surface high up the slopes. It is surprising to note that some of the springs, after the water has seeped through the red soil, are quite fresh and almost free from chloride.

In some instances in this district very deep planting is being done. It is a mistake, however, to plant more than 8 or 9 inches deep in this soil. The plant may, and probably will, strike well, but there are not sufficient supplies of food in the subsoil to sustain subsequent growth. Also, heavy rain after planting may place a

great deal of covering on the plants. Plant roots can generally be kept in the soil by adjusting the cultivators so that the soil is thrown away a little from the cane at each cultivation period.

Dallarnil.

The canegrowing area has been extended considerably. Heavy rains have fallen here since January, and the cane consequently is looking well. There is no doubt about the quality of the Dallarnil scrub soil. The cane is so well advanced now that frosts, if they occur, are not likely to do much damage. Farmers here are advised to go in as much as possible for early spring planting and use quick-growing and early-maturing varieties. A good standover cane is also to be recommended. Canes to be recommended are Q.813, H.Q.285, and E.K.1. Varieties doing well at Dallarnil beside the three mentioned are Rappoe, Uba, Striped Singapore, D.1135, and M.1900 Seedling.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MARCH, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING MARCH, 1923 AND 1924, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Mar.	No. of Years' Records.	Mar. 1923	Mar. 1924.		Mar.	No. of Years' Records.	Mar. 1923.	Mar. 1924.
North Coast.	In.		In.	In	*South Coast*—continued:	In.		In.	In.
Atherton	9·06	23	11·09	6·71					
Cairns	18·14	42	22·03	15·81	Nambour	9·31	28	3·71	6·28
Cardwell	16·09	52	7·27	25·37	Nanango	3·40	42	4·65	3·60
Cooktown	15·40	48	29·91	12·68	Rockhampton ...	4·85	37	0·55	5·33
Herberton	8·28	37	5·98	6·85	Woodford	8·03	37	4·64	6·47
Ingham	15·76	32	5·79	13·35					
Innisfail	25·79	43	22·51	41·96					
Mossman	18·86	15	18·14	13·59					
Townsville	7·63	53	0·66	12·76	*Darling Downs.*				
					Dalby	2·70	54	1·53	3·18
Central Coast.					Emu Vale	2·55	28	0·61	2·53
					Jimbour	2·63	36	2·70	1·81
Ayr	7·02	37	0·63	4·42	Miles	2·66	39	0·35	4·64
Bowen	5·83	53	1·11	3·10	Stanthorpe ...	2·75	51	2·13	1·88
Charters Towers ..	3·69	42	6·50	6·24	Toowoomba ...	3·85	52	1·33	5·27
Mackay	12·27	53	4·73	4·31	Warwick	2·64	59	1·70	2·52
Proserpine	11·95	21	4·75	5·51					
St. Lawrence ...	5·85	53	0·17	2·66	*Maranoa.*				
South Coast.					Roma	2·79	50	1·76	3·11
Biggenden	4·10	25	2·47	3·17					
Bundaberg	5·32	41	0·48	3·09	*State Farms, &c.*				
Brisbane	5·76	73	2·34	3·45					
Childers	4·87	29	0·68	4·80	Bungeworgorai ...	1·53	10	0·56	3·48
Crohamhurst ...	11·51	31	6·18	8·51	Gatton College ...	3·36	25	2·19	2·83
Esk	4·85	37	5·85	4·78	Gindie	2·80	25	2·62	0·16
Gayndah	3·25	53	2·02	2·26	Hermitage ...	2·39	18	0·52	2·38
Gympie	6·19	54	2·50	4·79	Kairi	8·28	10	11·72	1·21
Glasshouse Mts. ...	8·99	16	5·19	...	Sugar Experiment				
Kilkivan	3·98	45	1·79	3·37	Station, Mackay	11·21	27	2·82	3·89
Maryborough ...	6·23	53	2·41	7·37	Warren	2·47	10	0·00	4·92

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for March, 1924, and for the same period of 1923, having been compiled from telegraphic reports, are subject to revision.

J. H. HARTSHORN,
Acting State Meteorologist.

REPORT ON EGG-LAYING COMPETITION, Q.A.H.S. AND C., MARCH, 1924.

The competition commenced on 5th April, 1923, and concluded 31st March, 1924. It has been again a medium of establishing records, proving that the quality of the competing birds, both individually and collectively, is still on the up grade. The conditions attending this last test were not at all favourable. A fairly long spell of cold winds for the best part of the season checked egg production. The birds also had a rather bad time during the heat wave on 19th and 20th December. However, notwithstanding the drawbacks, the final figures were satisfactory. Mr. R. Burne's E. bird started to lay on 7th April, and missed only seventeen days to 31st March, thus establishing a world's record by laying 343 eggs in 362 days of the competition. In the light breed, Mr. C. H. Singer's B. bird put up a record with 333 eggs for the same period. In the other breeds, C. bird in the Ancona pen laid 282 eggs. Seven of the leading pens have been held over until the evening of 4th April to complete the full 365 days' score. Records:—

Competitors.	Breed.	March.	Total.
LIGHT BREEDS.			
*C. H. Singer	White Leghorns	126	1,600
*W. and G. W. Hindes	Do.	117	1,585
*N. A. Singer	Do.	119	1,583
*Oakleigh Poultry Farm	Do.	71	1,396
*Ancona Club	Anconas	100	1,363
*H. P. Clarke	White Leghorns	82	1,330
*S. L. Grenier	Do.	82	1,324
*Mrs. L. Andersen	Do.	61	1,285
*R. C. J. Turner	Do.	50	1,280
*Beckley Poultry Yards	Do.	50	1,276
*J. W. Newton	Do.	35	1,249
*Geo. Williams	Do.	87	1,240
*O. Goos	Do.	40	1,191
*C. A. Goos	Do.	66	1,179
*J. Purnell	Do.	89	1,166
*Rock View Poultry Farm	Do.	20	1,163
*Arch. Neil	Do.	68	1,155
*Bathurst Poultry Farm	Do.	25	1,130
*J. W. Short	Do.	51	1,109
*Mrs. R. E. Hodge	Do.	51	1,106
F. Sparsholt	Do.	66	1,092
*J. M. Manson	Do.	36	1,087
*H. Fraser	Do.	56	1,081
*N. J. Nairn	Do.	56	1,048
G. E. Rogers	Do.	63	1,025
*A. C. G. Wenck	Do.	20	1,024
Jas. Hutton	Do.	45	995
W. A. and J. Pitkeathly	Do.	55	987
W. and G. W. Hindes	Brown Leghorns	55	984
G. Marks	White Leghorns	38	980
E. Ainscough	Do.	52	972
W. Becker	Do.	42	950
Jas. Harrington	Do.	44	947
C. Quesnell	Do.	48	947
*M s. E. White	Do.	35	910
Parisian Poultry Farm	Do.	35	888
Chapman and Hill	Do.	47	880
Jas. Earl	Do.	51	876
HEAVY BREEDS.			
*R. Burns	Black Orpingtons	118	1,504
*Mrs. A. E. Gallagher	Do.	110	1,426
*Jas. Ferguson	Chinese Langshans	85	1,348
*W. Becker	Black Orpingtons	57	1,341
*Jas. Potter	Do.	51	1,330
*E. Walters	Do.	82	1,228
*T. Hindley	Do.	52	1,519

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	March.	Total.
HEAVY BREEDS—*continued.*			
*Jas. Hutton	Black Orpingtons	60	1,181
*Parisian Poultry Farm	Do.	51	1,179
*Mrs. A. Kent	Do.	26	1,175
*E. F. Dennis	Do.	71	,169
H. B. Stephens	Do.	70	1,118
*C. C. Dennis	Do.	48	1,104
J. R. Douglas	Do.	50	1,097
*R. Holmes	Do.	58	1,095
*H. M. Chaille	Do.	27	1,072
*J. H. Jones	White Wyandottes	51	1,070
Beckley Poultry Yards	Black Orpingtons	61	1,046
W. F. Solman	Do.	31	1,046
R. Conochie	Do.	60	1,043
W. F. Ruhl	Do.	55	1,015
G. E. Rogers	Do.	53	1,009
Rev. A. McAllister	Do.	45	960
V. J. Rye	Do.	60	923
Jas. Ferguson	Plymouth Rocks	34	888
F. J. Murphy	Black Orpingtons	57	888
W. G. Badcock	Chinese Langshans	46	855
Jas. Ferguson	Rhode Island Reds	40	730
Mos. Stephens	Black Orpingtons	15	660
Totals		3,858	75,078

* Indicates that the pen is being single tested.

DETAILS OF SINGLE HEN PENS.

Competitors.	A.	B.	C.	D.	E.	F.	Total.
LIGHT BREEDS.							
C. H. Singer	239	333	268	233	242	285	1,600
W. and G. W. Hindes	254	275	265	227	285	279	1,585
N. A. Singer	227	277	301	288	245	245	1,583
Oakleigh Poultry Farm	221	248	233	225	252	217	1,396
Ancona Club	203	245	282	191	200	242	1,363
H. P. Clarke	250	164	247	204	226	239	1,330
S. L. Grenier	187	238	260	219	203	217	1,324
Mrs. L. Andersen	191	222	234	225	217	196	1,285
R. C. J. Turner	209	211	204	207	201	248	1,280
Beckley Poultry Farm	207	191	198	235	225	220	1,276
J. W. Newton	235	225	200	172	205	212	1,249
Geo. Williams	232	240	200	193	185	190	1,240
O. Goos	187	210	212	196	184	202	1,191
C. A. Goos	201	215	143	217	193	210	1,179
J. Purnell	205	201	175	189	213	183	1,166
Rock View Poultry Farm	213	234	214	198	160	144	1,163
Arch. Neil	174	195	179	211	210	186	1,155
Bathurst Poultry Farm	193	196	157	221	183	180	1,130
J. W. Short	210	166	200	154	219	160	1,109
Mrs. R. E. Hodge	153	188	184	202	207	172	1,106
J. M. Manson	164	154	196	223	180	170	1,087
H. Fraser	183	157	185	189	202	165	1,081
N. J. Nairn	176	163	200	175	153	181	1,048
A. C. G. Wenck	187	169	134	184	150	200	1,024
Mrs. E. White	106	161	190	186	167	100	910

EGG-LAYING COMPETITION—*continued.*

DETAILS OF SINGLE HEN PENS—*continued.*

Competitors.	A.	B.	C.	D.	E.	F.	Total.
HEAVY BREEDS.							
R. Burns	254	275	214	204	343	214	1,504
Mrs. A. E. Gallagher	225	249	243	242	233	234	1,426
Jas. Ferguson	228	258	212	214	204	232	1,343
W. Becker	219	232	236	244	202	208	1,341
Jas. Potter	200	255	217	206	223	229	1,330
E. Walters	246	232	189	165	201	195	1,228
T. Hindley	200	210	212	203	192	178	1,195
Jas. Hutton	231	166	212	213	158	201	1,181
Mrs. A. Kent	169	228	156	251	185	186	1,175
Parisian Poultry Farm	172	200	194	215	198	200	1,179
E. F. Dennis	204	214	206	194	145	206	1,169
C. C. Dennis	197	209	141	186	188	183	1,104
R. Holmes	134	170	179	178	212	222	1,095
H. M. Chaille	177	200	195	169	155	176	1,072
J. H. Jones	193	200	186	144	145	202	1,070

J. K. MURRAY, Principal.

THE ZILLMERE EGG-LAYING COMPETITION FOR APRIL.

Exactly 1,800 eggs were laid at the above competition, which commenced on 1st April, an average of 10 eggs per bird for the month. The 111 White Leghorns averaged 10·6, the 48 Black Orpingtons 12, and the 21 other varieties 2 eggs per bird. Some birds have not yet commenced laying, a few pullets being hardly forward enough. No. 146 Black Orpington had to be replaced, owing to her laying abnormal eggs; and No. 112 was broody for a few days.

WHITE LEGHORNS.

Pen No.	Owner.	Total.	Pen No.	Owner.	Total.
65	E. Tracey	24	87	Enroh Pens	19
59	A. Staib	23	18	J. T. Webster	18
78	M. F. Newberry	23	32	W. and G. W. Hindes	18
20	A. Hodge	22	43	P. F. Adams	18
55	J. Hutton	22	92	C. A. Hodgson	18
66	E. Tracey	22	97	K. A. Sommerlad	18
90	R. Duff	22	64	E. Tracey	16
93	C. A. Hodgson	22	75	E. C. Raymond	16
103	P. F. Oakleigh	22	29	M. H. Campbell	15
6	H. T. Pember	21	50	J. Earl	15
12	W. J. Berry	21	51	J. Earl	15
19	A. Hodge	21	70	J. R. Wilson	15
67	Kidd Bros.	21	71	J. R. Wilson	15
80	J. Purnell	21	76	M. F. Newberry	15
85	Enroh Pens	21	81	J. Purnell	15
89	R. Duff	21	101	A. S. Walters	15
100	A. S. Walters	21	22	A. Neil	14
102	A. S. Walters	21	28	M. H. Campbell	14
57	J. Hutton	20	52	G. E. Rogers	14
104	P. F. Oakleigh	20	56	J. Hutton	14
21	A. Hodge	19	86	Enroh Pens	14
27	H. T. Britten	19	35	J. L. Chapman	13
31	W. and G. W. Hindes	19	40	R. C. Cole	13
42	R. C. Cole	19	60	A. Staib	13
44	P. F. Adams	19	61	P. F. Carinya	13
49	J. Earl	19	79	J. E. G. Purnell	12
54	G. E. Rogers	19	105	P. F. Oakleigh	12
84	W. Wakefield	19	26	H. T. Britten	11

THE ZILLMERE EGG LAYING COMPETITION—*continued.*

WHITE LEGHORNS—*continued.*

Pen No.	Owner.	Total.	Pen No.	Owner.	Total.
30	M. H. Campbell	11	17	J. T. Webster	2
82	W. Wakefield	11	24	A. Neil	2
1	F. J. Williams	10	46	R. C. J. Turner	2
88	R. Duff	10	83	W. Wakefield	2
173	S. L. Grenier	10	106	W. L. Howard	2
9	H. Sturman	8	2	F. J. Williams	1
36	J. L. Chapman	8	38	H. Fraser	1
73	E. C. Raymond	8	47	R. C. J. Turner	1
16	J. T. Webster	7	96	G. Williams	1
74	E. C. Raymond	7	108	W. L. Howard	1
95	G. Williams	7	5	H. T. Pember	0
174	S. L. Grenier	7	7	H. Sturman	0
10	W. J. Berry	6	8	H. Sturman	0
99	K. A. Sommerlad	5	11	W. J. Berry	0
172	S. L. Grenier	5	14	G. Marks	0
4	H. T. Pember	4	15	G. Marks	0
33	W. and G. W. Hindes	4	23	A. Neil	0
45	P. F. Adams	4	34	J. L. Chapman	0
48	R. C. J. Turner	4	37	H. Fraser	0
62	P. F. Carinya	4	53	G. E. Rogers	0
72	J. R. Wilson	4	58	A. Staib	0
3	F. J. Williams	3	63	P. F. Carinya	0
25	H. T. Britten	3	68	Kidd Bros.	0
39	H. Fraser	3	91	C. A. Hodgson	0
41	R. C. Cole	3	94	G. Williams	0
69	Kidd Bros.	3	98	K. A. Sommerlad	0
77	M. F. Newberry	3	107	W. L. Howard	0
13	G. Marks	2			

BLACK ORPINGTONS.

124	T. Brotherton	26	113	W. R. Wilson	10
143	F. P. Cummings	25	155	J. Hutton	10
115	G. L. Campbell	24	128	E. Walters	9
126	T. Brotherton	24	138	W. S. Adams	9
110	T. Fanning	23	111	T. Fanning	8
114	W. R. Wilson	23	153	Enroh Pens	8
144	F. P. Cummings	23	149	E. C. Raymond	7
119	H. M. Chaille	22	125	T. Brotherton	6
139	J. Pryde	22	127	E. Walters	6
142	F. P. Cummings	22	137	W. S. Adams	6
156	J. Hutton	22	134	C. C. Dennis	5
109	T. Fanning	21	135	C. C. Dennis	5
117	G. L. Campbell	21	136	W. S. Adams	5
112	W. R. Wilson	20	132	G. E. Rogers	4
116	G. L. Campbell	20	123	J. Potter	3
122	J. Potter	18	145	P. Y. Everlay	3
129	E. Walters	17	152	Enroh Pens	3
120	H. M. Chaille	16	118	H. M. Chaille	2
133	C. C. Dennis	16	121	J. Potter	1
148	E. C. Raymond	14	140	J. Pryde	1
147	P. F. Everlay	13	150	E. C. Raymond	1
131	G. E. Rogers	12	141	J. Pryde	0
154	J. Hutton	12	146	P. Y. Everlay	0
130	G. E. Rogers	11	151	Enroh Pens	0

OTHER VARIETIES.

175	P. Y. Everlay (B.L.)	12	163	A. S. Walters (B.R.)	0
159	P. F. Messines (R.I.R.)	9	164	A. S. Walters (B.R.)	0
167	W. H. Forsyth (S.W.)	8	165	A. S. Walters (B.R.)	0
166	W. H. Forsyth (S.W.)	6	168	W. H. Forsyth (S.W.)	0
176	P. Y. Everlay (B.L.)	3	169	J. Pryde (Lang.)	0
157	P. F. Messines (R.I.R.)	2	170	J. Pryde (Lang.)	0
171	J. Pryde (Lang.)	1	177	P. Y. Everlay (B.L.)	0
158	P. F. Messines (R.I.R.)	0	178	J. Ferguson and Son (B.L.)	0
160	T. C. Ollier (B.R.)	0	179	J. Ferguson and Son (B.L.)	0
161	T. C. Ollier (B.R.)	0	180	J. Ferguson and Son (B.L.)	0
162	T. C. Ollier (B.R.)	0			

SUGAR PESTS AND DISEASES IN THE MACKAY DISTRICT.

The Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby) has received the following report on Pests and Diseases in the Mackay district from Mr. W. Cottrell Dormer:—

Survey of the districts of Pinnacle, Owen's Creek, Finch Hatton Gorge, Hatton, Netherdale, Plane Creek, Mount Christian, and Carmilla.

DISEASES.

Knife Cut.

I found that this disease, or weakness, of D.1135 cane (Bundaberg) was or had recently been prevalent throughout the districts visited. I took special care in this connection to note whether the disease was, or was not, cumulative, and if it were propagated by seed. As a result of my observations and inquiries I do not think that the disease, if disease it is, is carried in any way by seed. Again, the fact that all wounds on any single stick are invariably on the same side of that stick seems to me to make the theory that the disease is carried by insects rather doubtful. However, "Knife Cut" is capable of inflicting severe damage to a crop both in tonnage and in sugar content. This was particularly evident on two farms near Sarina—Mr. T. Hughes and Mr. R. McKie.

Mosaic.

This disease was observed on one farm only—that of Mr. P. F. Wentzel, at Carmilla. Mr. Wentzel is keenly interested in the propagation of promising varieties. I noticed that at least 50 per cent. of H.168/04 was diseased with Mosaic. The affected stools, or most of them, were fully 18 inches to 24 inches shorter in top than the healthy stools. In some stools only a few sticks were affected, showing that these had caught the disease since planting. This small plot of diseased cane was surrounded by all of the abovenamed varieties and adjoined larger blocks of H.Q.426 and of M.1900 Seedling. I could not find one stool of these showing any signs of disease. However, this does not mean to say that these varieties are not susceptible. Incidentally, I would like to mention that the E.K.28 was looking remarkably vigorous and was making thick, solid cane rather more quickly than the surrounding varieties. The original stools of M.168/04, which supplied plants last year for the above canes, were next examined. Here the cumulative stunting action of Mosaic was well in evidence. The disease, though infectious, had only spread to one neighbouring stool of 7 R.428. It was, of course, pointed out to the grower that all stools of the variety M.168/04 should be ploughed out after the cutting. As it is not a very promising variety, it would not be worth his while to risk perpetuating the disease by keeping apparently healthy stools. I also advised the various growers I met in the district to call on Mr. Wentzel to see for themselves the disease in question. Whilst going through the farm I took special notice of sap-sucking insects on the cane. The following were observed:—Leaf Hopper (*Perkinsiella saccharicida*), Linear Bug (*Phœnacantha*), Leaf Hopper (*Astorga saccaricida*), Leaf Hopper (*Tetigonid*), Longwinged Leaf Hopper (*Sardis* sp.), and some Heteropterous larvæ, the imaginal form of which is unknown to me. The most plentiful of these was the first mentioned. This was present in tremendous numbers in all stages from egg to adult. I have never before seen them so plentiful. The Linear bug was also much in evidence. The importance of these insects lies, not in their direct injuriousness to the cane plant, which is but slight owing to their many natural enemies, but in their potentiality as disease carriers. I also noticed great numbers of a very minute mite (Accarid) below the cane leaf sheaths. These may have been subsisting on the fermenting juices and cells which are generally present at this part of the cane. Soil was a well-drained sandy brown loam near the banks of the Carmilla Creek.

Bleeding.

Two cases of death of ratoons owing to "bleeding" were described to me at Netherdale. I was unable to attribute any cause to this ailment, which appeared to have caused stools to dry up after the cutting last year. The varieties affected were H.Q.426 and D.1135, one man having lost two acres of the latter.

INSECT PESTS.

Lepidoderma albohirtum Waterh.—The notorious grey-back cane grub was found distributed throughout all the districts visited with the exception of Carmilla and Mount Christian. One notable feature of this distribution is that the worst of the damage done by this pest is invariably found in the loose, friable, and often sandy

soils of the creek and river flats. This applies especially to the Garget, Owen's Creek, Pinnacle, and Finch Hatton districts. The importance of this will be quickly realised after reading the next few lines. On Wednesday, 26th March, I visited Owen's Creek, and incidentally went through Mr. J. H. Morris's farm. I found this gentleman deeply interested in all work aiming at grub control. He had a bisulphide pump and some carbon bisulphide, and had treated several small plots and had obtained very good results, as much as 80 per cent. to 90 per cent. mortality being observed amongst the grubs. Accompanied by Mr. Morris and by Messrs. Thorning Bros., I selected a spot and injected about 1 chain with ½-oz. doses on both sides of stool. The soil was friable but damp, and not in the best condition for fumigation, as it contained a percentage of wet clay. However, two days later Mr. Morris examined nine stools. Only five sheltered grubs. His findings were as follows:—Dead, 60 per cent.; sick, 20 per cent.; healthy, 20 per cent. This meant an eventual mortality of 80 per cent. Thus, if such results could be obtained in Mr. Morris's rather damp soil (I did not anticipate a bigger mortality than about 50 per cent.), what results could be expected in more sandy soils where the worst of the damage is done? The cost of fumigation by hand with carbon bisulphide runs from about £4 to £4 10s. per acre. Later, if para-dichlor. comes up to expectations, fumigation will be a great deal cheaper. When cane is fairly big, the more erect varieties are naturally the easiest to treat.

Grubs were found at their worst in the Pinnacle and Owen's Creek districts. After having become accustomed to seeing an occasional first or young second-stage grub round about the Mackay districts, I was very much taken by surprise when Mr. H. McLean and Mr. D. Bourke, of Pinnacle Plain, turned up some very large and very active third-stage grubs. Last year about 14 acres of Badila were completely destroyed on the farm of which the latter of the abovementioned growers has charge. The soil is a loose black alluvial loam, and, in plant cane at least, would prove quite suitable for fumigation. Several of the farms situated on the loose alluvial flats of Plane Creek are similarly affected. Mr. McLean, of Pinnacle, recently cut down all feeding trees on his creek frontage and states that grub damage on his farm has thus been minimised to a great extent.

Other Grubs.

One young second-stage grub of *Lepidiota frenchi* was found on a farm in the Owen's Creek district. As the season is getting rather late, practically all third-stage grubs of this species have "gone down" deep into the soil to hibernate previous to pupating. The single grub found was under a stool of D.1135. *Anomala australasiae* was represented in my finds by a single second-stage grub found under a stool of Clark's Seedling on an alluvial flat at Owen's Creek. Several large third and second stage grubs of *Dasygnathus australis* were found at Pinnacle and Owen's Creek, under stools of Badila and of D.1135 respectively (47, 50). A small *Heteronyx* sp. was found in all stages throughout districts visited. These are of no economic importance.

Other Insect Pests.

Most of the sap-sucking insects have already been noticed under Mosaic. The first of these mentioned, *Perkinsiella saccharicida*, is the common little greyish-coloured leaf hopper one sees in almost any canefield. However, it was nowhere so plentiful as it was at Carmilla. The Linear bug, though so very common in the North, was only observed at Carmilla, though doubtlessly it occurs in the other districts visited. The next hopper mentioned, *Astorga saccharicida*, a rather broad and flattened winged insect, measuring about ¼ inch in length and of a brownish colour, is also common enough throughout the district. Mealy bugs, *Pseudococcus calceolariæ*, is another very common sap-sucking insect. It is to be found most plentifully on varieties with loose leaf sheaths such as D.1135. Evidence of damage of the large Moth Borer (*Phragmatiphila truncata*) was obtained everywhere I went. The caterpillars were actually found attacking a block of Shahjahanpur 10 on Mr. R. McKie's farm, near Sarina. This pest has also frequently been reported to me as attacking varieties Uba and D.1135 which, on account of their hard rind, are seldom favoured by the beetle borer (*Rhabdocnemis obscurus*). This last pest is also well distributed according to descriptions given by growers. However, none of these borers do any serious damage or call for active control measures. I did not actually find the beetle borer in any stage, and have had to depend solely on descriptions given me by growers of grub and damage. Wire worms, *Monocrepidius* sp., though well distributed, do but very slight damage and only in low-lying fields. White ants, *Termes* sp., occasionally cause some supplying, but they seem only to occur in fields containing old roots or stumps, though occasionally they have been known to form a

nest below a stool and hollow out all the sticks. The large white ant of the Lower Burdekin, *Mastotermes darwiniensis*, was not found anywhere and apparently does not occur in the Mackay districts. The Army Worm, *Cirphis unipuncta*, was mentioned by growers at Finch Hatton and at Carmilla. The damage done by them, however, was but slight compared to that often experienced in the Cairns district. Another, but a very minor, Lepidopterous pest was observed at Finch Hatton and at Sarina. This is *Melanitis leda*, a common brown butterfly, whose green caterpillars usually feed on grass but sometimes on cane leaves. Another sap-sucking insect which I omitted to mention above is *Aleurodes berghi*, a colony of which I found on a leaf of D.1135 at Carmilla, a very small grey insect of the leaf hopper tribe (*Homoptera*). The female has a peculiar habit of laying her eggs in a circle, turning about on the one spot to do so. This pest is of very minor importance. At Finch Hatton Mr. A. Bergmann gave me a description of some Dipterous larvæ which had attacked his plants last year and prevented them from striking. They were small grey maggots about $\frac{5}{8}$ inch long and would cluster all around the nodes, apparently to feed on the young root buds.

Wallabies and Other Pests.

On the whole, wallabies seem to have been the most serious pest the growers of all outlying districts have had to put up with. Practically all of these growers have lost from 1 to 4 acres. In some parts the wallabies have been known to actually dig the set right out when attacking very young plant cane. One grower, Mr. R. McKie, of Sarina, mentioned that they were wont at times to camp in the tall cane, when they would pull the cane about and destroy it wantonly and thus make playgrounds out of some fields. Many farmers have resorted to shooting and trapping, whilst others rely solely upon dogs. Several growers mentioned have destroyed as many as fifty and sixty wallabies during last season. At Finch Hatton Gorge it was reported that cockatoos had lately done serious damage on two farms. Mr. P. Connolly, of Carmilla, mentioned having had 6 acres of young plant Badila cane destroyed by grey kangaroos. Both of these pests are, to the best of my knowledge, new to cane. Scrub turkeys are also reputed with doing rather serious damage in places in the Finch Hatton and Plane Creek districts. However, none of these animals do much damage in normal good years. Coots do slight damage in most of the creek districts, especially on farms situated near swamps.

Digger Wasps and other Grub Destroyers.

The most common digger wasp (*Campsomeris tasmaniensis*) was observed at Sarina and at Carmilla. Carabid beetles and larvæ (*Gnathaphanus pulcher*, &c.) occur in the soil throughout the cane districts.

Cane-killing Weed.

Something of a scare seems to have started on the canefields of the upper reaches of Carmilla Creek. A certain weed is to be found growing in these fields amongst the cane. Here and there may be seen small patches of very stunted cane surrounded by perfectly healthy stools. In these patches the weed thrives and has, therefore, been put down by the Carmilla growers as being the cause of the stunting.

Survey of the districts of Racecourse, Mackay and Palms, Farleigh, Pleystowe, and Marian.

DISEASES.

All these districts I found remarkably free from disease. At the Mackay Experiment Station, Mr. Keogh, the Chemist in charge, pointed out a few stools of D. 1457 affected by Leaf-stripe disease (*Solorospora sacchari* Miz.), and also some stools suffering from Mosaic disease. These stools have all been carefully destroyed. I noticed what I took to be Mosaic disease in a whole field of cane near the Palms Mill, and also in a small block of Q. 813 belonging to Mr. F. Martin, whose farm is at Mandarana, near Farleigh. Knife-cut disease appears to have been prevalent last year in D. 1135 growing at Devereaux Creek, in the Marian district. Another possible disease is that which many farmers call Bunchy Top. This is a crumpling and twisting of the growing cane leaves about the heart in such a way as to make the progress of this part of the cane very difficult. However, the curled leaves die and rot after a time and the cane seems to recover. This is mostly to be found in 1900 Seedling, though Q. 813 and other varieties are also susceptible. This so-called disease may be due to the sudden breaking of the drought and consequent fast growth of the cane.

PESTS.

Grubs.

The most easily found cane-grub at present is that of *Lepidiota frenchi* Blkb. These I found scattered throughout the districts visited, about 99 per cent. of them being in the third stage and ready to go down to hibernation. As this grub has a two-year life cycle it does most of its damage during the warm months of the year, *i.e.*, after its first winter under ground. Actual evidence of damage was obtained in several places. Cane is generally affected by this grub when in the young ratoon stage, it then becomes stunted and is at times killed outright. At the Experiment Station several patches of Q. 813 and of D. 1135 were badly stunted in this way. Mr. J. McDonald has only recently had to plough out about 8 or 9 acres of ratoon for this reason. About two acres of Q. 813 belonging to Mr. G. Anable, of Racecourse, large patches of Q. 813 in a field belonging to Mr. A. N. Willis, of Te Kowai, and about 2 square chains of Clark's Seedling belonging to Mr. J. McKay, of Palingra, were rendered useless by this grub. In each case excepting the last the soil was of a heavy consistency and unsuitable for fumigation. However, Mr. McKay's soil could be treated with certain success, it being a very open sandy loam. Mr. McKay had already put down a top dressing of common salt at the rate of 575 lb. to the acre, as an experiment, but a live grub was found under a stool in spite of this. Grubs of *Lepidoderma albohirtum* Waterh., "the greyback," were not at all easy to find, yet they have been responsible for a great deal more damage. Complaints were lodged against this notorious pest in several quarters. Thus the Greyback grub is well distributed also. Mr. Watson, of Racecourse, stated having lost about £2,000 worth of cane and labour through grubs. In the worst of the grub-infested spots the soil was found to be quite suitable for fumigation with either para-dichlor or carbon bisulphide, the damage being mostly done on the sandy river flats or in well drained and open soil amongst the forest hills, such as Habana and Devereaux Creek. In every case the farmer was advised as to method of procedure in fumigation. Endeavour was made also, to point out the main differences between true Melolonthid cane grubs, which feed on the living cane roots, and other grubs which only feed on old sets or dead stools and very seldom do any damage. One very simple thing to remember in this connection is that no true cane grub (such as *L. albotirtum* and *L. frenchi*) will ever under any circumstances crawl on its belly. Another thing which growers could remember is that it is an exceedingly rare thing to find a true cane grub under old wood. I mention this because all grubs appear to be the same to the uninitiated eye.

By following ploughs and digging holes I found several other species of grubs, some of which are of interest. *Heteronyx* sp. (*sollicitus*?) is exceedingly common and is to be found throughout the districts in larval, pupal, and imaginal stages; it is of no economic importance, as it is a very tiny brown cockchafer often seen flying to light. *Dasygnathus australis* is also well distributed; was found in each district in the larval stage; in each case it was found eating dead sets, dead roots, or old wood in the soil. *Anoplognathus* sp. was also found feeding on old wood; the species was quite unknown to me and was found at Marian; a specimen was sent to the entomologist at Meringa. Another species of *Anoplognathus* was found under weeds in a sandy loam on river bank at Racecourse. *Lepidiota* 615 (?) was found feeding on the roots of Malagache in very sandy soil near the Pioneer Bridge; the grubs have previously been recorded from sandy river beds, but I fancy that this is the first record of their attacking sugar-cane; only one grub was found. Two grubs of *Horonotus optatus* were found in the same field as *Lep.* 615, and the remarks concerning this latter also apply here. Grubs and adults of *Noso flavipennis* are to be found through the districts, and a species of *Haplonycha* (unknown to me) is to be found in places. One first-stage larva and a female of the "Elephant" Beetle (*Xylotrupes australicus* Thoms.) was found while digging beneath some old wood on a farm near Croker's Hill.

A more serious pest than any of these is the Wire Worm (*Mono. crepidius* sp.) This insect, which attacks the eyes of sets and thus prevents "striking," occurs plentifully in all low-lying cane fields. It does its damage mostly during the colder months. The experience of growers seems to point to lime as a good repellent. Cases were mentioned to me that where cowpea was used as a green manure wire worms were worst. It is possible that cowpea might prove attractive to the *Monocrepidius* beetle, who might be prompted to deposit eggs amongst its roots. But this remains to be tested by experiment. However, some growers are of opinion that the beetle lays her eggs on the young pea pods and that the larvæ develop in these pods, so that when the crop is ploughed in they attack the sets in seeking further nourishment. This idea is quite erroneous, as the wire worms spend the whole of their larval state in the soil. The borings that growers see in the pea pods (which, it seems, led to this false idea) are caused entirely by caterpillars of moths and by insects other than wire worms. The larvæ have a two or three years' life

cycle, so that possibly they do more damage some years than others at regular intervals in the same way as grubs of *L. frenchi.*

In every field that I have visited I have noticed beetles of *Gonocephalum* sp. (*torridum* or *carpentercæ* or both) running about the soil about cane stools. The larvæ of these beetles are small cylindrical wire worms attaining a length of ¾ inch. They feed upon the young roots of growing cane, piercing them with numerous small pits, thus leaving the roots exposed to the many root diseases which may be present in the soil. *Pentodon australis,* a small Dynastid beetle, is quite common about here, and is frequently to be seen at bright lights. At Farleigh I found seven specimens under the one electric light. This suggests light traps as a form of control should this pest ever become serious. During most of my travelling I carried a specimen with me, and the majority of growers recognised it as a beetle usually attracted to their lamps. However, only one farmer had ever noticed the beetle at work. This was Mr. C. Dolby, near Croker's Hill, on the main Farleigh road. He stated having found the beetle in holes gnawed at the base of stalks of Clark's Seedling about 2 inches below the surface of the soil. This was in October last. He was prompted to look when he noticed that odd sticks were inexplicably yellowing and dying. At Te Kowai, on the Palms Estate, I found similar injury at the base of sticks of standover Clark's Seedling. In both instances holes were dug under and about old affected stools, but no grubs could be found and the beetles had left. Grasshoppers (*Locusta danica, L. australis,* &c.) were plentiful in all districts, but were doing very slight injury to the foliage. Mention was made to me in most parts of pest attacks of the Army Worm (*Cirphis unipuncta* Haw.), but I did not actually see any larvæ or moths. The beetle-borer (*Rhabdocnemis obscurus* Boisd.) is, according to descriptions of growers, well distributed throughout the districts. However, the slight damage it does now is no greater than that which was done by it ten or twelve years ago, so that it is very unlikely that borers will ever become serious. One or two farmers in each district gave me vague descriptions of moth borers and of longicorn borers. In this connection I have advised growers to always keep handy in their houses a well-corked pickle bottle containing a fair quantity (say, half gallon) of methylated spirits, in which they could throw any borer, grub, or other pest of interest, so that whenever an officer of the Entomological and Pathological Divisions of the Bureau was passing through the district they could produce the pest on which they want information. Of course if they could send specimens to the Entomological Laboratory at Meringa it might be better, but it is not always convenient for growers to do this. *Perkinsiella saccharicida* and other sap-sucking pests, including the Mealy Bug, are to be found in every locality, but seem to be kept well in check by natural enemies. The Leaf Miner (*Cosmopteryx* sp.) and the Bud Moth (*Spogona*) were also noticed in sparse numbers. In no instance did I see any field of cane with the leaf mid-ribs mined by *Cosmopteryx* to the extent that it is usual to see in the Badila of the more Northern canefield.

Natural Enemies of Cane Pests.

I have not yet seen any digger wasps (*Campsomeris*), but have, in places, while following plough, picked up small cocoons attached to the remains of small grubs, These cocoons, which in every case were damaged when found, were probably those of a species of *Typhia.* Several times, whilst following plough, I have picked up larvæ of *Asilus illingworthi* and of a species of *Scenooinid* (*diptera*) similar, if not identical, to those which have been bred from Northern canefields. Both of these are predaceous larvæ, the former, which breeds into a robber fly, at least, being partial to grubs. I was told by Mr. Davidson, of Te Kowai, that amongst the grub-eating birds of the districts immediately about the river, the seagull took a very prominent position, as it comes in great numbers, is very quick, and has a great appetite. Crows and kookaburras are also of great use in this way.

Wallabies, Coots, &c.

Wallabies appear to have done considerable damage in the more outlying districts, but mostly in dry weather, some farmers having completely lost three to four acres of cane. It appears that these animals tackle the big cane as well as the small, sitting up and eating the heart or cabbage of the softer varieties. The stick then shoots up from the nodes and becomes useless for harvesting. The wallabies even go further at times and break the stick down altogether. Mr. Axam, manager at Farleigh, mentioned that an acquaintance of his had resorted to poisoning as a control measure. He would pull down a couple of leaf sheaths and thus expose the

softer and less-developed part of the cane, then drive the point of his knife into the cabbage and force some strychnine into the cut. This was done to odd sticks here and there. On the morning following his first attempt he found seven dead wallabies. Another farmer had tried dropping arsenic about the heart of the stick and thinks that he obtained success. Another pest which attacks the cane in a similar fashion is the coot, or water fowl, which does serious damage in lands adjoining swamps. Mr. Davidson, of Te Kowai, informed me, amongst other things, that last year, in the very dry weather, native companions and geese became troublesome. The former on one occasion destroyed two acres of cowpea and corn.

Lateness of Beetle Season.

In all these districts I have been constantly finding greyback beetles on their feeding trees. At Pleystowe I examined in one case four and in another six beetles shaken down. In the first instance two were females and in the second the females numbered five. At Racecourse I found a tree near Mr. Watson's farm which supported at least one hundred beetles. I examined twelve of these taken at random and found that nine of them were females. I had already examined a number, the big majority of which were females. All these females contained immature eggs from one-eighth to a-half developed in numbers varying from about two to eight. This examination was made on the 13th March. The Pleystowe ones were later.

MILKING RECORDS, COLLEGE DAIRY HERD, MARCH, 1924.

Name of Cow.	Breed.	Date of Calving.	Total Milk.	Test.	Butter.	Remarks.
			Lb.	%	Lb.	
College Cobalt ..	Jersey ..	14 Sept., 1923	780	4·7	42·90	
Iron Plate ..	,,	3 Mar., 1924	728	4·9	42·00	
Dawn of Warragaburra	,,	10 Nov., 1923	660	4·9	38·10	
College Wildflower	,,	13 Aug., 1923	630	5·1	37·80	
Netherton Belle	Ayrshire	30 Oct., 1923	780	4·1	37·50	
College Sunrise..	Jersey ..	3 Jan., 1924	720	4·3	36·00	
College Grandeur	,,	11 July, 1923	510	5·9	35·40	
Magnet's Leda ..	,,	18 Aug., 1923	630	4·5	33·30	
Miss Fearless ..	Ayrshire	17 Nov., 1923	660	4·0	30·60	
Comedienne ..	Jersey ..	10 July, 1923	480	5·4	30·60	
Hedges Nattie ..	Friesian	21 Nov., 1923	690	3·7	29·70	
Bellona	Ayrshire	3 Aug., 1923	600	4·2	29·40	
College Promise	Jersey ..	14 Aug., 1923	540	4·6	29·10	
College Desire ..	Ayrshire	11 July, 1923	546	4·5	28·98	
Hedges Madge ..	Friesian	18 Aug., 1923	660	3·7	28·50	
Buttercup ..	Shorthorn	7 Sept., 1923	720	3·4	28·50	
Guid Lassie ..	Ayrshire	— Jan., 1924	630	3·8	28·20	
Songstress ..	,,	22 Aug., 1923	600	4·0	27·90	
Miss Betty ..	Jersey ..	30 Oct., 1923	570	4·1	27·30	
Dear Lassie ..	Ayrshire	1 Nov., 1923	540	4·3	27·00	
Fair Lassie ..	,,	28 Nov., 1923	540	4·3	27 00	
College Meadow Queen	Friesian	10 Jan., 1924	660	3·3	25·20	
Yarraview Snowdrop	Guernsey	7 Sept., 1923	420	5·0	24·60	
College Hope ..	Jersey ..	21 Oct., 1923	420	5·0	24·60	
College St. Margaret	,,	7 July, 1923	418	4·9	23·94	
Lady Meg ..	Ayrshire	14 July, 1923	540	3·5	21·90	
Gay Lassie ..	,,	5 July, 1923	460	3·9	21·24	
College St. Martha	Jersey ..	25 June, 1923	324	5·5	21·06	
Confidante ..	Ayrshire	7 Sept., 1923	510	3·5	20·70	
Miss Faithful ..	,,	— Jan., 1924	420	4·1	20·10	
College Queen Nan	Friesian	15 Feb., 1924	540	3·2	20·10	

BANANA WEEVIL BORER (*Cosmopilites sordidus*, Chev.)

SIXTH PROGRESS REPORT.

By JOHN L. FROGGATT, B.Sc., Entomologist.

LETTER OF TRANSMITTAL.

3rd March, 1924.

This Bulletin (the Banana Weevil Borer, *Cosmopolites sordidus*, Cherv., Progress Report 6, by J. L. Froggatt, B.Sc.) embodies a wealth of exact detail concerning the insect to which it relates.

Whatever measures for its control have been devised have been conditioned—as is obvious they must be—by considerations of its habits and life history, in the elucidation of which the author's past work has been especially valuable and significant.

Whatever improvement be made with respect to these measures, as well as any additional ones that may be reached, must also be the outcome of such further facts as are herein brought to light.

These must therefore be regarded as of especial value and interest in solving the important problem affecting the Banana-growing Industry that the presence in Australia by the injurious insect alluded to truly constitutes.

Henry Tryon, Government Entomologist.

As knowledge of the banana weevil borer becomes disseminated, and the devastation caused by this pest is realised, greater interest is being paid to this problem. As a consequence, information is being more eagerly sought for, resulting in a closer examination of the individual plantations. In this way we are finding that the area over which this beetle is already dispersed is considerably greater than was heretofore known. The assistance given by growers has been of great value, not only in adding to our knowledge of the distribution and habits of the pest, but also in testing in the field some of the more promising laboratory results in control measures. Co-operation has been forthcoming, however, from isolated individuals rather than from groups, and when the great number of banana-growers there are in the State, and the number that have even offered to assist are compared, the spirit of helpfulness is very slight indeed.

Many new plantations have been laid out, often without any inquiries being made regarding pests, with the result that beetle borer has later been found to be present, and in by far the greater number of cases the occurrence can be easily traced to its having been brought in with the original suckers. It cannot be denied that in certain instances this source does not readily explain the occurrence.

The longer the practical handling of the problem is allowed to lie in abeyance, the greater will be the difficulties besetting its control. Not only will the area of dispersion and the degree of infestation be greater, but also there will be so much more plant material that will have to be cleaned out, that even a single year's increase in this connection will be enormous.

Although the course of the investigations has, through unavoidable circumstances, been seriously interrupted, progress has been made and further valuable information obtained.

The Egg.

The time passed in the egg stage during January, 1923, averaged 4 days, and rose at the end of May to 27 days. Through June, July, and the early part of August very few eggs were obtained, and those separated from the corm were destroyed by fungus growths, which developed in the incisions made in the plant portions to which the eggs were transferred for observation. At the end of August the period was 21 to 22 days, and remained at 7 to 9 days from early in October through November, falling to 5 days in December (*vide* Table A).

The number of eggs deposited showed similar fluctuations throughout the year to those previously recorded, rising markedly in April and September, and falling very low in June and December (*vide* Table B).

The Larva.

A large number of larvæ were transferred to thin slices of corm, which were changed as required. The mortality amongst the newly emerged grubs on transference was very high, while a few of the partially developed ones were found dead in

the tunnels and covered in mould. It was not possible to ascertain whether this fungus growth was the cause of death or not, but it was thought to be rather a post-death development. Larvæ transferred immediately prior to, or after, moulting often failed to re-establish themselves in the fresh corm. At this time they have a quiescent period of several hours at least, and after moulting the sclerites of the head take some time to harden.

With eggs laid early in May, 1923, the larval period was greatly extended through the cold climatic conditions, occupying an average of 123 days, whereas with eggs laid in December, 1922, the period averaged 34 days. The longest period noted occurred with eggs laid 9-14/5/23, 130-133 days being passed in the larval state. The pre-pupal period has shown but slight variation through the year, occupying from 1 to 3 days.

It has been noted that with a larval period of 35 to 45 days there are at least three moults, one occurring about 8 days, another 18 days, and a third 24 days after emergence. With a larval period of 50-60 days a moult was noted about 32 days after emergence.

The Pupa.

The pupal period averaged about 8 days, but under conditions of lowered temperature it has lengthened to an average of 15 days.

The Life Cycle (*i.e.*, from deposition of egg to emergence of the beetle from the pupa) has naturally shown very wide variations at different periods of the year, ranging from 46 days (average) to 156 days (average). In the former case the eggs were laid early in December, 1922, and in the latter early in May, 1923 (*vide* Table C).

The longest life cycle period noted was with eggs laid 30/4/23 to 4/5/23, the imago emerging 10-11/10/23, a period of 159 to 165 days. Throughout the developmental periods of the beetle no data have so far been obtained on which a plan might be formed for destroying the insect while inside the plant. In the present state of our knowledge of this pest, the adult weevil is, therefore, the only stage over which control measures, other than cultural, can be exercised.

PLATE 66.—GRUB PUPA, AND ADULT OF BEETLE BORER.
(Natural size.)

The Imago.

Further records on the life of the weevil confirm that both in colonies and in solitary confinement, it lives for a very long time. From a consideration of all the laboratory data available on the longevity of the imago, the rate of mortality appears to be higher during March, April, and May than at any other period of the year (*vide* Table D).

A series of tests were made in order to study its powers of maintaining life without food. These have brought forward some extremely interesting information. For this work a fixed number of beetles were confined in tins 4 in. by 3 in. by 2 in. with soil. In each series a control lot was run with food; in a second tin the soil was dry, and in the third it was kept damp by adding a little water as required. In the dry soil the beetles died in about 6 days; this was fairly constant throughout all the tests made to date. In the damp soil, however, the last death occurred in from 70 to 121 days of the inception of the tests. The average life through several series was 97.5 days (*vide* Table E). The time of year appears to be an influencing factor, so further work will have to be done on these lines. The beetles for these tests were drawn from supplies collected in the field, their age being therefore unknown; it is possible that this may also be an influencing factor. The longevity without food has a large bearing on the question of replanting bananas on land from which the stools have been dug out. It is evident from these results that, provided every portion of banana plant is dug out and destroyed immediately, six months at least should be allowed to lapse before any replanting is undertaken. Since it is quite possible that under perfectly natural conditions the length of life may be longer than shown by the laboratory results, and also portions of plant material may be left behind on which the beetles could feed for a time, a full year should be allowed from digging out to replanting.

The effect of excessive moisture on the beetles without food was studied. In the earlier series the following procedure was adopted:—Five small jars were taken; in the first (a control) the beetles were placed in sifted soil with food; in the second the soil was damp; in the third the soil was thoroughly wetted; in the fourth the soil was waterlogged; in the fifth the beetles were submerged in water without any soil. The weevils were exposed under these conditions for varying periods of time, and were then transferred on to a banana corm over dry earth. The effect on their life noted in these tests was very slight over periods up to 2½ days.

In later series, only the submergence in water was tested, and in this connection it would appear that the time of year is again an influencing factor. Over short periods of submergence (*i.e.*, up to 2 days) mortality is not very high, but from 6 to 10 days, although the beetles are for the major part alive when transferred, they die within a short time afterwards in the spring. In July, 52.5 per cent. were killed as a result of submergence of from 120¼ hours to 288¾ hours (5 to 12 days approximately), while in August 100 per cent. were killed in periods from 147½ hours to 264 hours (7-11 days approximately). A submergence of 48 hours in September only caused the death of 40 per cent., whereas from 62 to 135 hours' submergence resulted in a mortality of 93.3 per cent. (*vide* Table F).

Suckers used for planting have been found at times to contain living beetles. It has been stated that soaking corms in water for a number of hours would kill this pest. From the results just quoted this is evidently a fallacy, especially when it is considered that the conditions of the tests were the most rigorous it was possible to obtain. Both these lines of research emphasise the extreme tenacity with which these beetles cling to life.

Action of Poisons on the Beetles.

During the last active period, further work was done on the effect of poisons on the imago. Attention was concentrated on the two chemicals—sodium arsenite and "Paris green" (copper aceto-arsenate). Arsenic trioxide was also used; the action of the latter appears to be much slower than that of the two former ones, but further work requires to be done with it. "Paris green" still appears to

be the most satisfactory poison used to date, having a stronger action than any of the others, resulting in the death of the greatest number in a shorter time. The procedure was the same as that given in my third report (*vide* "Queensland Agricultural Journal," 22nd October, 1923, page 289.) The pieces of corm were shaken up in the mixture for from five to twenty minutes and placed in separate tins with sifted soil. An equal number of beetles were then placed in each tin and left with the poisoned material for varying periods of time; at the termination of each of which fresh (untreated) corm was substituted for the treated portions. Observations were made from day to day to ascertain the number alive. This work was carried out in tins 4 inches by 3 inches by 2 inches. The diluent used with the powder poisons was in every case wheaten flour.

The following chemicals have been used to date:—

Sodium arsenite, both in solution and as a dry powder; mercuric chloride (corrosive sublimate) in solution; barium chloride in solution; Paris green as a dry powder; calcium arsenate as a dry powder; lead arsenate as a dry powder; borax (sodium tetraborate) as a dry powder; copper resinate as a dry powder; copper sulphate (bluestone) as a dry powder; arsenic trioxide (commercial) as a dry powder; barium sulphate as a dry powder; sodium acetate as a concentrated solution.

A summary of the laboratory results to date may be of interest. As has been previously stated ("Queensland Agricultural Journal," June, 1923, page 524), the chemicals in solution have been found to be unsatisfactory, the best results having been obtained with those used as dry powders.

Poison.	How Used—A Powder or in Solution.	Dilution.	Period of Year.	Exposure to Poison, in Hours.	Per Cent. Killed.	Control Per Cent. Alive.
		Per Cent.		Hours.		
Barium Chloride ..	In Solution ..	5	November	18–48	2	100
	ditto ..	2	ditto ..	18–48	6	100
	ditto ..	1	ditto ..	18–48	1	100
Mercuric Chloride ..	ditto ..	0·1	ditto ..	18–48	2·5	100
	ditto ..	·06	ditto ..	18–48	2·5	100
	ditto ..	·05	ditto ..	18–48	2	100
Sodium Arsenite ..	ditto ..	2	October ..	18–48	10·5	100
	ditto ..	1	ditto ..	18–48	1·5	100
	ditto ..	·5	ditto ..	18–48	2	100
	Powder ..	1·3	June ..	18–54	92·5	100
	ditto ..	1·3	September	18–42	100	100
	ditto ..	1·6	ditto ..	18–42	98	100
	ditto ..	1·3	ditto ..	3–24	74·4	100
	ditto ..	1·6	ditto ..	3–24	69·4	90
Arsenic Trioxide ..	ditto ..	1·3	October ..	18–72	88·1	90
Borax	ditto ..	1·3	June ..	18–60	80	100
	ditto ..	Pure ..	July ..	18–58	85	90
	ditto ..	ditto	September	18–66	94·4	100
	ditto ..	ditto	November	3–24	43·8	90
Calcium Arsenate ..	ditto ..	ditto	April ..	18–48	71·3	100
	ditto ..	1·6	ditto ..	19–48	63·1	100
Lead Arsenate ..	ditto ..	1·6	May ..	19–92	20	100
Paris Green	ditto ..	Pure ..	February ..	18–48	99·4	80
	ditto ..	1·6	March ..	18–48	96·9	100
	ditto ..	1·6	ditto ..	3–24	97·5	80
	ditto ..	1·6	April ..	½–3	56·9	90
	Suspension in weak flour paste	..	February ..	18–48	80·6	100
Barium Sulphate ..	Dry Powder ..	1·6	January ..	18–48	14·4	100
Copper Resinate ..	ditto ..	2·3	April ..	18–48	2·5	100
Copper Sulphate ..	ditto ..	2·3	May ..	18–48	2·5	100
Sodium Acetate ..	In Solution ..	Concentrated	December ..	18–66	27·8	100

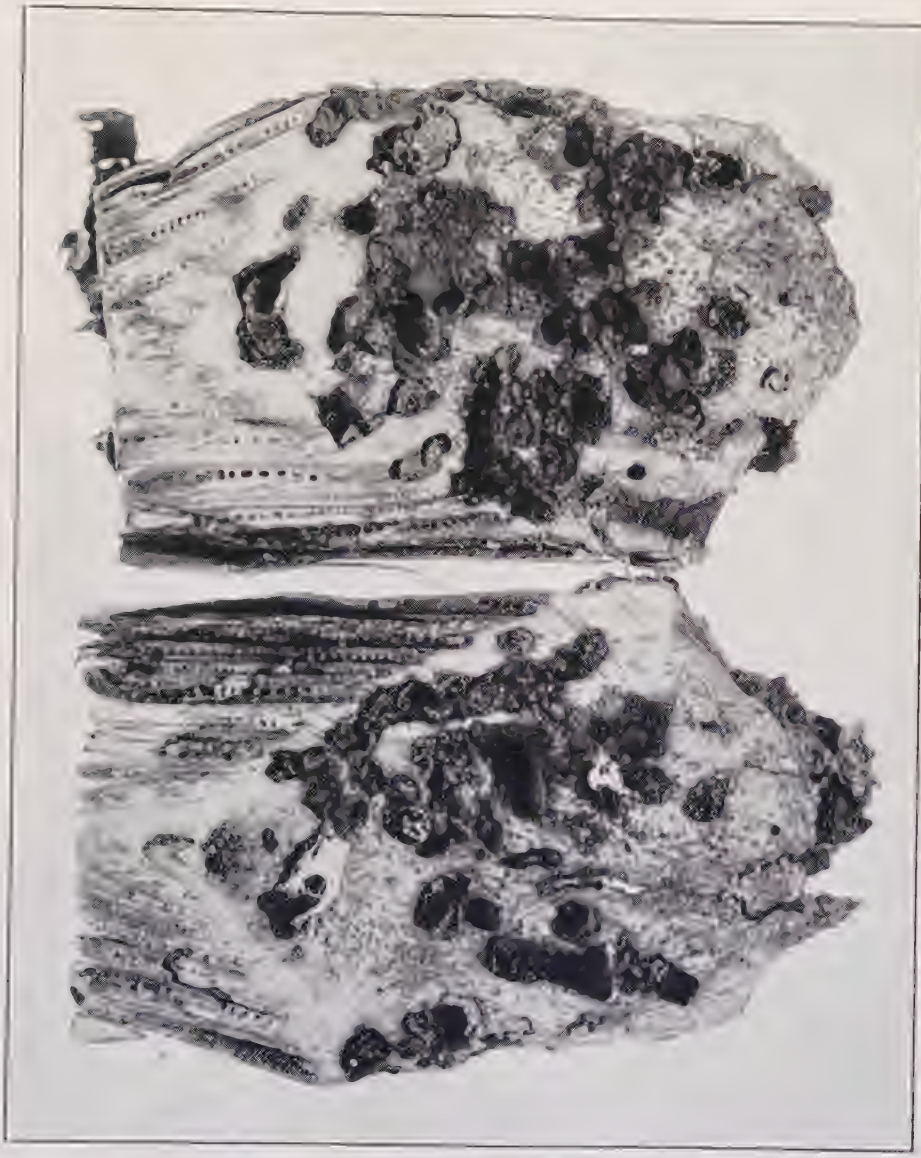

Plate 67.—Banana Sucker, about three months old, showing Severe Infestation by the Borer

It is seen from these figures that the most promising results to date were obtained with Paris green and sodium arsenite, followed by arsenic trioxide and borax. Calcium arsenate gave fair results, and further work will be done in testing it in other series during more active periods.

The simple copper and barium salts have been decidedly disappointing.

The course of this work, particularly, was seriously checked last year by a variety of unavoidable circumstances. Since it has been found that the rate of mortality under similar conditions is less in the inactive than in the active periods, this experimental work has had to be confined to those times when the maximum effect might be expected, thus prolonging the time taken for this investigation far beyond what was anticipated. The results to date show, however, that we have one poison at any rate that will cause a high rate of mortality when the beetles are exposed to it for only a short period of time. It may be stated that this one, Paris green, has been used in the field with very promising results. Further research may show that a still more satisfactory poison, or mixture, may be obtained.

In reference to the flight of the adult insect, there are no laboratory data of a positive nature on which to base any opinoins. Information has been received, however, from several correspondents showing that flight does occur under certain conditions, the nature of which are unknown. This data may be thus summarised.

In one case beetles were found in a vessel just inside, and in another in a tub just outside, the house. The distance from banana stools to where the imagos were found was from 10 to 30 yards. The first observation was made early in December, and the second early in February. No specimens were submitted for identification, and data on climatic conditions were incomplete.

In another case the beetles flew into the room through a large open shutter, a little after 7 p.m. on a warm, cloudy night early in February. In one other instance the beetles flew at night at a height of about 12 feet on to a table on the veranda of a house situated close to banana stools. The climatic conditions were given as "muggy after a day's solid rain." This occurred during the first week in March. In both the two latter instances the beetles were collected and sent in for identification.

Owing to the normal abhorrence of light shown by the beetles, this is a very difficult matter to follow up. Our knowledge of the factors governing flight is at present nil, and until fuller and more definite information is obtained on this matter it is not possible to state to what extent the flight of the beetles will influence the present practice of control.

It would appear from the observations to date that the powers of flight are not greatly exercised. It may be found that flight only occurs for a very short period of the year, and for short distances. Wind is certain to exercise a great influence over the distance they may travel.

From the above observations on this mode of progression, it will be observed that every record of flight so far falls within the inactive periods of the beetle existence, or at a time when the females would not be burdened with the task of actively developing eggs. There is also the possibility that they may be ones that are recently matured and unmated.

There now can be no doubt but that the beetles do fly under certain undetermined conditions during the summer months, such flight occurring at night. It must be regarded as a potential menace, particularly where old abandoned or badly neglected plantations exist where the beetle is breeding unhindered in large numbers, and must, sooner or later, look further afield for fresh food and breeding grounds. These need to be completely destroyed and measures undertaken to destroy the beetles present.

Control.

It has been stated that the flight of beetles would render present methods of control more or less useless. This cannot be allowed to pass without comment. It refers either (1) to the advised necessity of obtaining suckers free from the pest for planting; or (2) to the question of cleaning up plantations.

In reference to (1) the question may be asked—Is it better to start with a plantation free from the pest and run the possible risk of having odd beetles fly in at some indeterminate period to make slow headway for a time, or to obtain suckers from any plantation which is more than likely infested with the borer, with the result that most certainly some, if not many, of the plants will be put in the ground with the pest already in them? All thinking men will surely agree that the former is the preferabe way to set out. If cultural methods are practised from the time the plantation is begun, a careful watch will show early signs of any infestation should

such occur, and the labour of control measures should not then be very great. But to knowingly plant borer with the suckers, which is constantly being done, means an early termination to the productivity of the plantation and a poor return for the labour and outlay.

In reference to (2), if the beetle is already in a plantation and cultural methods have been conscientiously carried out, the pest will be prevented from increasing in numbers to a very large extent, and in this way the devastation caused is minimised very greatly. For this reason alone such work can never be wasted.

The means of cleaning up a plantation and the reasons for it have been dealt with in previous reports, hence there is no need to recapitulate them here. Directions for the use of poisons on baits may prove of interest to some. It must, however, be first emphasised that poison baits alone are *not* sufficient to kill out the beetles in any area. They only minimise very considerably the labour and time spent in going round and examining the ordinary unpoisoned corm, and collecting and destroying the beetles found under them.

Thoroughly mix one part of Paris green with six parts of flour; this is best done by shaking the two together in a large tin. From this transfer what is required into a smaller tin with a finely perforated lid, which can be carried round. Dust the powder over the freshly cut baits, composed either of pieces of corm or split stem, and lay them face down on the bare ground wherever infestation has been observed; the best site at stools is inside or just outside. If there is any trash about, it is advisable to cover the bait over with a little of it; this prevents the bait drying too rapidly, and also makes the immediate vicinity darker, which is what the beetle prefers. These baits should be examined from time to time and renewed as required. Dusting the poison mixture over the stumps of plants when such are freshly cut off close to ground level is also of great assistance in this connection. Both this and the covering over of the baits have been proved to be advantageous by the grower who was giving the mixture a field trial.

It must be constantly borne in mind, in considering the question of control, that—

(1) The grub not only damages the plants, but passes the whole of its life inside them; for this reason it cannot be reached by any ordinary method of treatment for insect pests.

(2) The beetle lays the eggs, from which comes the grub. In the adult stage this weevil lives outside the plant, and is therefore vulnerable.

(3) By destroying breeding grounds and harbourage as far as possible, the pest cannot increase in numbers at such a rapid rate as would otherwise occur, and for lack of outside shelter is driven into the stools, where it can be treated more readily than when it is broadcasted through the plantation.

If any grower should be in doubt at any time about the borer, he has only to write in to the Department of Agriculture, Brisbane, and all information available, and any advice possible, will be willingly supplied.

TABLE A.

Eggs Laid.	Days to First Sign of Mandibles.	Days thence to First Emergence.	Days for Total Emergence.
30/12/22 to 6/1/23	..	..	4 to 5·5
5/4/23 to 30/4/23	9	2	11 to 13·5
30/4/23 to 24/5/23	12·5	2·5	14·5 to 19
24/8/23 to 28/9/23	14	2	14·6 to 18·4
28/9/23 to 29/10/23	7	1	8·7 to 10·4
29/10/23 to 29/11/23	6	1·5	7·2 to 8·2
29/11/23 to 18/12/23	5	1	5·8 to 7

TABLE B.

1923.	Lot. X.	Y.	Z.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Monthly Totals.
January	23	46	31	18	26	47	46	2	..	..	..	..	..	..	..	..	..	239
February	8	5	8	2	8	10	4	0	..	..	..	..	..	..	..	..	..	45
March	17	10	13	8	12	35	4	9	..	..	..	..	..	..	..	..	..	108
April	42	16	68	16	31	188	75	1	38	..	..	..	..	..	..	..	..	475
May	26	13	61	6	7	218	105	..	180	..	From 7/9/23.	From 27/9/23.	..	..	..	..	..	616
June	2	4	33	1	2	75	56	..	58	..			..	..	..	..	..	231
July	..	..	2	1	0	19	5	..	24	..			..	..	..	..	..	51
August	..	..	1	..	..	6	2	..	15	17			..	..	..	..	..	41
September	..	..	2	..	..	99	21	..	170	149	60	24	..	..	..	..	..	525
October	..	..	..	..	..	17	0	..	372	229	245	268	35	..	..	..	..	1,166
November	..	..	..	..	..	..	..	..	126	141	86	101	18	123	127	9	..	731
December	..	..	..	..	..	..	..	..	11	30	16	52	5	36	27	116	3	296
Total—Year	118	94	219	52	86	714	318	12	994	566	407	445	58	159	154	125	3	4,524
Eggs laid to 30/12/22	711	881	699	309	260	210	210	0	..	..	..	..	..	..	..	..	..	..
Totals for each lot	829	972	918	361	346	924	528	12	994	566	407	445	58	159	154	125	3	..

TABLE C.

Eggs Laid.	Egg Period in Days.	Larval Period in Days.	Pre-pupal Period in Days.	Pupal Period in Days.	Life Cycle in Days.
20–24/11/22	5– 8	41– 45	..	6– 8	54– 59
4–15/12/22	5– 8	30– 38	..	4–10	44– 50
30/14/23—14/5/23 ..	15–19	118–128	..	10–21	154–159
3–18/9/23	15–20	40– 44	2–4	7– 8	63– 71
5–26/10/23	8– 9	34– 40	1–2	7–10	50– 54
29/10/23—13/11/23	5– 8	32– 43	1–3	5– 8	51– 57

TABLE D.

Collected or Bred.	Reference to Series Lot.	Date of Collection or Breeding.	Date of Last Death.	Life in Days.	In Terms of Lunar Months.					
					Months.	Weeks.	Days.	Months.	Weeks.	Days.
Collected ..	X	20–21/7/22	1–14/8/23	376—391	13	1	2	— 13	3	6
Ditto ..	Y	1–12/8/22	24/8/23 to 3/9/23	377—391	13	1	3	— 13	3	6
Ditto ..	Z	1–16/9/22	21–28/9/23	370—392	13	0	6	— 14	0	0
Ditto ..	1	13/10/22	10–17/7/23	270—277	9	2	4	— 9	3	4
Ditto ..	2	18/10/22	1–14/8/23	287—301	10	1	0	— 10	3	0
Ditto ..	3	7–8/11/22	22–26/10/23	348—353	12	1	5	— 12	2	3
Ditto ..	4	27–30/11/22	2–5/10/23	306—313	10	3	5	— 11	0	5
Ditto ..	5	1–4/12/22	9–13/4/23	126—133	4	2	0	— 4	3	0
Ditto ..	6	13–18/4/23	22–28/1/24	259—270	9	1	0	— 9	2	4
Ditto ..	7	25–26/7/23	1–11/2/24	190—201	6	3	1	— 7	0	5
Ditto ..	Single	23/2/22	9–12/3/23	379—382	13	2	1	— 13	2	4
Bred ..	38	11–12/12/22	3–7/12/23	356—361	12	2	6	— 12	3	6
Ditto ..	50	11/12/22	16–19/10/23	309—313	11	0	1	— 11	0	5
Ditto ..	68	14–15/12/22	30/8/23 to 3/9/23	268—273	9	2	2	— 9	3	0
Ditto ..	97	17–18/12/22	2–5/10/23	288—292	10	1	1	— 10	1	5

TABLE E.

Series.	Date Started.	Longevity.	
		In Dry Soil.	In Moist Soil.
		Days.	Days.
1	10/4/23	4– 6	107
2	22/5/23	5– 6	121
3	24/8/23	6– 7	85
5	4/10/23	4– 6	70
6	18/10/23	9–10	98
7	15/11/23	8– 9	102

TABLE F.

Series.	Date Started.	Per cent. Alive on	In Control.	No. 1.	No. 2.	No. 3.	No. 4.
2	19/9/22	30/9/22	90	70%	80%	100%	90%
	Period of	submergence	..	96 hrs.	96 hrs.	96 hrs.	96 hrs.
3	16/6/23	12/7/23	100	90%	90%	90%	100%
	Period of	submergence	..	48 hrs.	72 hrs.	96 hrs.	120 hrs.
4	12/7/23	16/8/23	50	50%	40%	70%	30%
	Period of	submergence	..	120 hrs.	194 hrs.	265 hrs.	289 hrs.
5	27–8–23	14/9/23	70	0%	0%	0%	0%
	Period of	submergence	..	147 hrs.	216 hrs.	240 hrs.	264 hrs.
6	12/9/23	28/9/23	50	60%	10%	0%	10%
	Period of	submergence	..	48 hrs.	62 hrs.	110 hrs.	135 hrs.

RATOON COTTON.

"In the early stages of the controversy on the Ratoon Cotton Question, a promise was made," said the Acting Minister for Agriculture and Stock (Hon. W. Forgan Smith) in the course of a recent Press statement, "that a test would be carried out on the English markets to secure an impartial report upon ratoon cotton from the English market point of view." "On the 9th November, 1923," continued the Minister, "the s.s. 'Leitrim' carried from Brisbane thirteen bales of cotton consigned to the Agent-General for Queensland in order to comply with the promise made to the advocates of the practice of ratooning. These thirteen bales were made up as follows:—(*a*) Ten bales of Upland ratoon lint; (*b*) two bales of Durango ratoon lint; (*c*) one bale of Annual Durango. As the promise made was to secure an impartial report on ratoon cotton, this consignment was put in the hands of Messrs. A. J. Bustom and Co., a private firm of cotton brokers at Liverpool, which firm is in no way connected with the British Australian Cotton Association, the Empire Cotton Growing Corporation, or the British Cotton Growing Corporation, and the report from this firm upon this consignment is therefore an unbiassed one, and is interesting, as it shows distinctly that the ten bales of Upland ratoon lint were valued at ¼d. to 1½d. per lb. less than the middling American cotton, which is the standard grade accepted all over the world."

As regards the two bales of Durango ratoon, which realised ¾d. to 1¼d. above middling American, the Minister pointed out that this lint was from properly ratooned pure Durango plants, and it was to be expected that the valuation would be at a higher price than the ordinary ratoon.

The bale of Annual Durango which was sent with the consignment was valued at 2d. above the value of middling American, and this valuation shows a marked difference in the values placed on annual and ratoon cotton on the English market.

"The Sydney market and the Japanese market were also tested some time ago," continued Mr. Forgan Smith, "with the same results in favour of annual cotton."

The results of all these shipments emphasise the desirability of keeping up the quality of Australian cotton to the highest pitch, because it will be realised that it is only by so doing that we can hope to make cotton-growing a permanent industry in this State.

BREEDS OF PIGS.

E. J. SHELTON, H.D.A., Instructor in Pig Raising.

THE DUROC-JERSEY A RECENTLY INTRODUCED AMERICAN TYPE.

There are several breeds of pigs in the United States of America which have been developed under purely local conditions, yet which have proved themselves as of considerable value in the uplift of that greatest of all American ventures, the hog industry. The Poland China (of which we in Queensland know something, as the type was introduced many years ago), which originated in the States of Ohio and Illinois; the Duroc-Jersey, which came into its own in New Jersey and in New York; the Chester White, whose native home is claimed to be the State of Pennsylvania; the Victoria, a breed developed in New York and Indiana; the Cheshire, also originating in New York State; the Hampshire, or the belted breed; and the Mule Foot, whose originators claim as being immune from swine fever (in America always referred to as hog cholera).

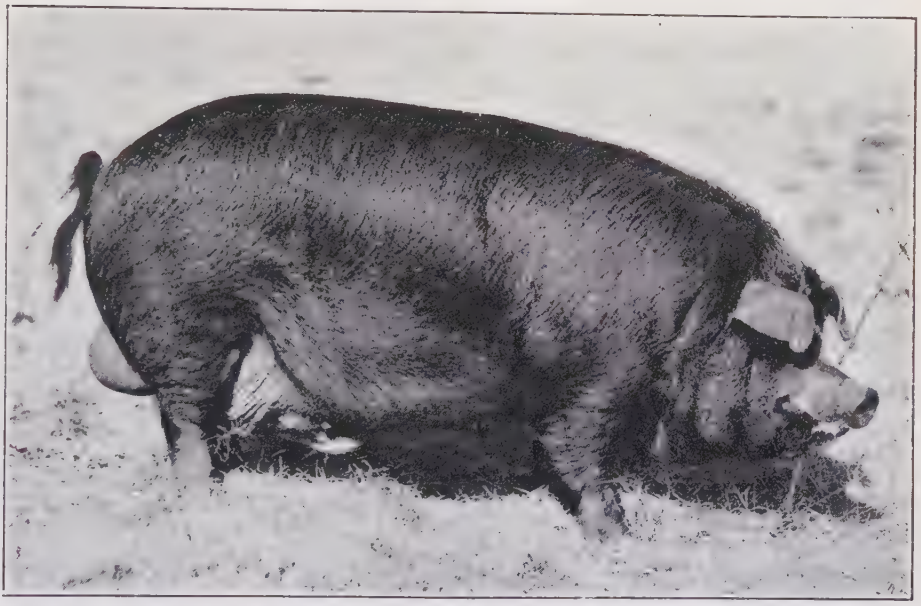

PLATE 68.—DUROC-JERSEY BOAR.
A Prominent Prize-winner at American State Fairs.

The Duroc-Jersey.

It was during the autumn months of 1922 that the Duroc-Jersey breed of pig was first introduced into Australia, the importation comprising one boar and two young sows from Canada to the order of Mr. Fred. G. Brown, of Moorabin, Toogoolawah, a Queensland enthusiast who had a few months prior to that date toured Canada, and was so impressed with the breed that he had made several purchases. The pigs were but ten weeks old when they arrived here, and were somewhat out of condition as a result of the long ocean voyage, hence did not attract the attention they would have done under other and possibly more favourable circumstances; but after a few weeks' careful handling and feeding in their new home they began to put on flesh, and were so well advanced that at the age of five months they were exhibited for the first time in Australia at the Brisbane Show.

It was estimated by the writer at that time (five months old) they would weigh 120-130 lb. dressed weight, and many competent pig buyers discussed their merits, and it was generally agreed they represented a very superior type of animal; a pig which should do remarkably well under Australian conditions, where we aim at quick growth and early maturity, and where these special qualifications count much in their

favour, and where the red pig (for they are cherry red in colour) has advanced in popularity and is, particularly in Queensland and New South Wales, in good demand.

Since that date both sows have proved to be excellent breeders, rearing good litters of pigs of even better type than the parents. As an illustration, one of the suckers, when five weeks, weighed 38 lb., and developed so rapidly that when four days under three months old he and several of his litter mates weighed from 73 lb. each, in the case of the picked pigs, down to 65 lb. in the case of one or two smaller sows, these figures having been certified to by Mr. Brown at the time the pigs were weighed. These are remarkable weights in comparison with our general average here, and should go a long way towards popularising the type.

The Origin of the Duroc-Jersey.

The Duroc-Jersey is of American origin, though at present, owing to export regulations, the importation of pigs from the United States of America is practically prohibited, hence our supplies come from Canada, where the type is also largely bred, and where the regulations governing export overseas are less stringent.

To show the extent to which the breed has been distributed, it is officially stated by the Duroc-Jersey Swine Breeders' Association of the United States of America that more than 40 per cent. of the pedigreed pigs in the United States of America

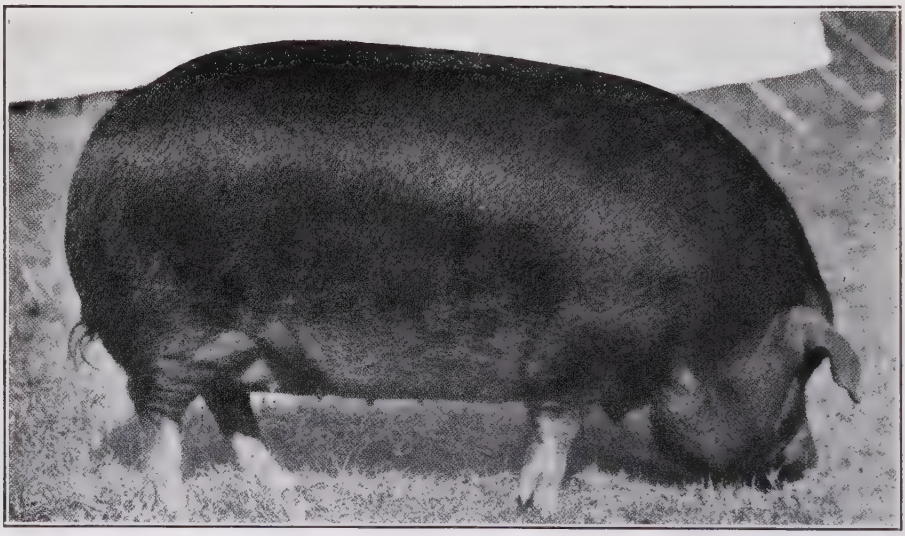

PLATE 69.—A GRAND CHAMPION DUROC-JERSEY SOW AT AMERICAN STATE FAIRS.

to-day are of this breed. The type appears to have been developed from a strain of pig introduced into America from Spain as far back as the year 1820. These were red or sandy-coloured hogs that had the reputation of growing to an enormous size with a good quality flesh. Doubtless, during the days of American slavery, when ships traded with different countries carrying slaves and food supplies, &c., some of the more interested chiefs carried with them as "booty" some of these red hogs, for we have authentic record of their having been introduced both from Guinea and New Jersey, as well as from Spain. It is presumed that they were introduced by or for breeders who had a fancy for a red hog, for hogs of that colour were well known "way down in Tennessee" and in Saratoga, New York, and were considered to be far superior to the types common in most States, though they were smaller and apparently less profitable than the Spanish type appeared to be. It is possible, too, that descendants of the old English Berkshire, which were introduced later to improve and develop the Poland-China, may have reverted to a reddish-coloured hog, for these old English types were all inclined that way many years ago, and even at the present time we find the Berkshire has this tendency when their breeding is neglected, though we look upon this as a sign of degeneracy more than as a result of neglect. Historical records further prove that the Berkshires of olden times were of a reddish hue (there is a "Red" Berkshire breed in America to-day). So it was that between the several types fanciers of the red pig made their choice, and by continued effort in the

direction named they eventually produced a permanently red pig of great value. The Spanish type had during this period commonly been known as the Jersey Reds, and those found so numerously in Saratoga were styled the Durocs. The blending of the two types proved so profitable that it was eventually agreed to combine the two names, using the American type as the standard, hence they have from that date been known under the title of the Duroc-Jersey. Other names by which the breed had previously been known were the Jerseys, the Red Rocks, the Clay Rocks, the Dew Rocks, the Red Graziers, the Red Berkshires, and the Red Guineas.

It was in 1883 that the American Duroc-Jersey Swine Breeders' Association was formed in Chicago, and the name was then formally adopted. As we now have them they are not unlike the Berkshire or Poland-China, except in colour, and they make up into excellent quality pork or medium weight bacon pigs at a very early age and on a comparatively small amount of food.

The ideal colour that breeders aim at is a cherry red, though both bright red and dark cherry are allowed. It would appear that as yet the colour is not permanently fixed—even the Tamworth pigs vary a good deal in colour, and they are one of the oldest breeds known. The colouration of animals is in itself a very interesting study.

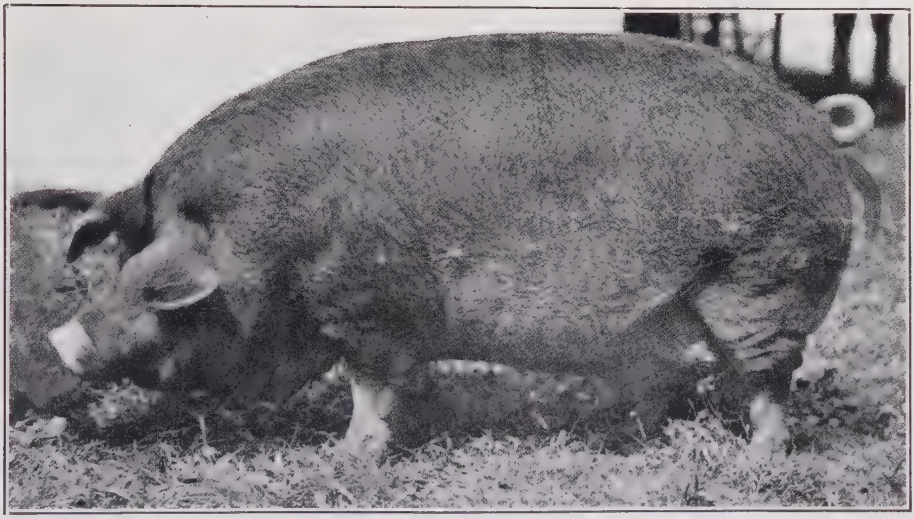

Plate 70.—An Aged Duroc-Jersey Sow.
A well-known American Prize-winner.

The Type.

In America and Canada the Duroc-Jerseys are classed as "lard hogs"; that is, they belong to a type of pig that fattens rapidly and develops into a medium sized fat pig. In disposition they are very docile and contented, in itself a very valuable feature in any breed; they are active and vigorous, good paddock pigs, though they may not stand extreme heat, whilst they are equally prolific, if not more so, than Poland-Chinas, in general, producing litters of from eight up to fourteen. In this respect it is doubtful if any of the other American breeds can surpass them.

For Australian conditions they should be an extremely useful type, where bacon-curers and pork butchers have a decided fancy for red or spotted red and black pigs.

Further importations of the breed will doubtless be arranged for later on. A quartette of young sows and an unrelated boar arrived quite recently to supplement the first shipment; but, of course, it yet remains to be seen whether they will become as popular as our other and more firmly established types.

FRUIT FLY INVESTIGATION.

ENTOMOLOGIST'S REPORT.

The Minister for Agriculture and Stock (Hon. W. N. Gillies) has made available the following report, dated 29th April, of the Entomologist at Stanthorpe, Mr. Hubert Jarvis, in relation to the Fruit Fly and certain other insects either harmful or useful:—

FRUIT FLY.

1. *Fruit Fly.*—During the months of February and March, 1924, the Fruit Fly, *Chætodacus tryoni*, was prevalent throughout the Granite Belt District, all the latest ripening fruits being badly attacked.

Many orchardists reported "the Fly" visiting their orchards in a swarm, and attacking all available fruit. This would seem to indicate either an enormous natural increase of "Fly" within the district or a visitation from infested areas outside the Granite Belt, or perhaps derivation from both of these sources.

There was, it may be added, a noticeable lack of interest in "Orchard Hygiene" (*i.e.*, the gathering and destruction of all "fly-stung" fruit) during the latter end of the season.

Poison-bait sprays or repellants were apparently useless in preventing Fruit Fly attack during February, and more particularly in March. Female Fruit Flies, trapped and examined during both these months, were in nearly every case fully matured and ready to deposit eggs.

The fruits principally attacked during February were late peaches, pears, apples, and quinces. In March, however, it was discovered that the Fruit Fly was ovipositing in several other fruits—both wild and cultivated ones. About 12th March Fruit Fly maggots were discovered in grapes in the Stanthorpe district. On 25th March all doubt, if any then existed, as regards the Fruit Fly (*C. tryoni*) attacking this fruit vanished. The fly was watched at work among grapes, and many larvæ, both small and large, were found within the fruit; and, moreover, 180 Fruit Flies were caught in two traps that had been set for seven days among the vines.

Fortunately, however, only a small percentage of Fruit Fly maggots seem to reach maturity in grapes, owing principally to the juice of these rapidly fermenting, a condition being thus brought about which quickly proves fatal to them. Not so, however, to the little fermentation fly, *Drosophila*. This latter fly is only about ⅛ inch in length, and literally swarms around punctured or cracked fruit, in which it deposits its eggs. The numerous resulting maggots undoubtedly help to bring about that fermentation so fatal to the Fruit Fly maggots proper; in fact, the little *Drosophilid* larvæ seem to thrive when living under this circumstance.

Further, on 13th March, Fruit Fly maggots were found at Ballandean, in, too, the fruit of the common naturalised blackberry (*Rubus fructicosus*); and, on a search being made in blackberries in other localities within the district, additional Fruit Fly maggots were discovered in them also. [*Note.*—A number of the maggots from this source were placed in the insectary in jars, and ten Fruit Flies have to date emerged. All these flies proved to be the notorious fruit-pest *Chætodacus tryoni*.]

On 31st March, still additional associations were brought to light, Fruit Fly maggots being then found in tomatoes and also in Cape gooseberries (*Physalis*) in cultivation.

2. *New Fruit Fly.**—This large and handsome Fruit Fly was first captured by me at the Summit in February, 1921; in 1922 it was also observed during both February and March on cultivated fruits; but efforts to rear examples of the species from fruit maggots proved unavailing until this season. Both sexes of the insect have now been bred in the insectary from pear, and quince also.

* The discovery of this Fruit Fly has been referred to by us in the Brisbane daily Press, under the designation "Jarvis' Fruit Fly."—H.T.

This fly appears to be distributed throughout the district, since specimens are to hand from Applethorpe, The Summit, Thulimba, Dalveen, and Glen Aplin. All specimens obtained at large were female flies and were caught in traps; four males as well as many females have, however, now been bred from maggots in fruit, and thus in viewing both sexes, that this fly is a species distinct from *Chætodacus tryoni* is quite evident. In the field it is strikingly different from this latter species, being entirely golden yellow in colour, with very bright, iridescent-green or golden-green eyes. It is thus easily recognised when on the fruit, and was noticed by many orchardists this season.

Although a late comer this Fruit Fly, apparently, does not hibernate (overwinter) here, as it never makes its appearance until towards the end of February, and it is only reasonable to suppose that, in the event of its overwintering as a pupa, it would make its appearance in the spring or early summer. This, however, as I have stated, is not the case.

3. *Destruction of Maggot-infested Fruit.*—Although boiling is recognised as a safe and effective way of destroying the eggs and maggots of the Fruit Fly in infested fruit, I am of opinion that drowning, if properly carried out, is equally effective and safe, and can be resorted to whenever and wherever circumstances admit of its use. An old tank or large barrel will answer the purpose very well; it should be about half filled with water, and the fruit first emptied into it as collected. This fruit—generally a mixture of all sorts and varieties—quickly starts to ferment, thus destroying all Fruit Fly maggots and eggs. Any fruit floating on the surface can be easily kept under water by placing an old sheet of galvanised iron on top of it, and then placing a stone on top of the iron. If desired, a small cupful of kerosene can be poured on the surface of the water; this will kill any grubs or maggots that come in contact with it. Provided that an old tank, or even barrel, be available, the above is a quick and cheap way of dealing with maggot-infested fruit. The fruit can be left in the barrel for weeks or all the season if desired; and the longer it has been soaking the more effective will be the liquid in destroying Fruit Fly maggots.

4. *Field Experiments.*—In order to ascertain if the Fruit Fly overwinter as a pupa in the Granite Belt area, numerous wire-gauze cages containing maggot-infested fruit have been placed out—at Dalveen, The Summit, Applethorpe, and Stanthorpe—and additional ones will also be placed out during May at other places in the district.

Fruit Flies are being kept alive in large cages, under almost natural conditions, in the insectary. The first of these flies hatched on 1st April; daily additional hatchings have brought the total up to forty-five. These cages are standing in soil and there is ample room within them for the flies to move their wings freely and to visit fruit suspended from the roof of each, for possible ovipositing and other roof purposes.

WOOLLY APHIS OF APPLE.

Woolly Aphis Parasite (Aphelinus mali).—On the 18th March, acting on instructions from the Chief Entomologist, Mr. H. Tryon, Mr. A. A. Girault (Assistant Entomologist—a recognised authority on Chalcididæ) was met at Stanthorpe and conducted to the orchard where over fifty Woolly Aphis parasites had been liberated. Within the first half-hour one parasite was seen crawling on the under surface of a leaf, and it was not long before a specimen was also secured; this proved to be the Woolly Aphis parasite (*Aphelinus mali*). Two other specimens were caught on apple trees situated some distance away from the tree on which the insects were first liberated. Thus it is reasonable to conclude that this useful Chalcid wasp is established in at least one orchard.

Further supplies of *Aphelinus mali* have, moreover, been promised by Dr. R. J. Tillyard, M.A., &c., and should arrive here during the winter. Given thus more favourable weather conditions than those obtaining through August and September, 1923, when the previous consignment was received, it is hoped to establish this insect in further additional orchards next season. Owing to the short life of the adult parasite ("a small wasp"), it is impracticable to transmit it in a living state during the summer. The parasite passes the winter months as a pupa, or chrysalis, within the old shell of the aphid that it has destroyed, and in this stage of its existence it can, on the other hand, be readily sent long distances with safety.

OTHER INJURIOUS INSECTS.

1. *Codling Moth.*—Much damage has been caused by the Codling Moth in the Stanthorpe district during February and March, and it is estimated by most growers that their losses this season were due rather to Codling Moth than Fruit Fly. Throughout the month of March, Codling Moth larvæ or caterpillars were found in fruit. These larvæ were of all ages, from quite small grubs to the full-grown stage insects.

The cleaning up of packing sheds throughout the district is of the utmost importance in fighting this pest. Packing benches should be taken to pieces and carefully examined for larvæ, and if possible an easily movable type of bench installed in their places.

A hasty spraying with merely hot water, or soda solution, is not effective in destroying Codling Moth larvæ; boiling water or water as near the boiling point as possible, if poured into all cracks and crevices, will kill all sheltering larvæ therein. Codling Moth grubs have been found to be alive and active several days after crawling over, and being stationary on, wood thoroughly wet with a strong caustic soda solution; the close silk-envelope around the resting larva protects it from any but the strongest spray.

The Codling Moth has this season been present in practically every orchard, where apples and pears are grown, in this district. But, notwithstanding, I am convinced that co-operative efforts in opportune spraying, and the cleansing of sheds, &c., will deal an effective blow to this serious pest.

2. *Tomato Caterpillar (Chloridea obsoleta).*—Considerable damage has been caused during the latter end of this season by the Tomato Caterpillar (*Chloridea obsoleta*). This insect also attacks cotton and corn (maize). It has been fully described and illustrated by Mr. H. Tryon (Government Entomologist and Pathologist) in a recent published pamphlet, "Insects Injurious to Cotton." This bulletin can be obtained from the Department of Agriculture and Stock, Brisbane, or from this office.

The moth (the final phase in the life of this insect) is stout in build, with strong wings, that measure when expanded about 1½ inches. It lays its eggs singly on the young leaves or flowers of the tomato, and on these hatching the tiny caterpillars pass the early stage of their existence feeding externally on the leaves of the host plant; and, generally when about three-parts grown only, they attack the fruit of the tomato, eating their way right into the inside, and feeding there, comparatively safe from enemies. When full-grown (about 1½ inches long) they leave the fruit and burrow into the soil, where they turn to a shinny brown chrysalis, and this chrysalis in due time gives rise to the moth or perfect insect.

Fortunately, this pest is kept in check in this district by several parasites, both Dipterous and Hymenopterous ones. A small Braconid wasp is one of the most important enemies of the Tomato Caterpillar, and clusters of the small white cocoons of this friendly insect may often be noticed on the leaves, sometimes close to where the caterpillars are feeding, and in some cases attached to a caterpillar. The wasp lays its eggs in the caterpillar, and the wasp-grubs, on hatching, gradually feed on the tissues of their host—this Tomato Caterpillar—and they quickly destroy it. When full-size, they leave the host and pupate outside in clusters. A caterpillar when once attacked soon remains stationary until it dies.

A small Bombylid fly is also a very beneficial insect in aiding in the destruction of the Tomato Caterpillar. This fly I have watched laying its egg on this host (the Tomato Caterpillar), which very much resents the operation, moving thus the posterior end of its body rapidly up and down, apparently to frighten the fly. Many caterpillars collected showed the egg of this fly generally laid near the third or fourth segment. The maggot on hatching from this egg probably works its way into the body of the host, underneath one of the segments or through a spiracle.

Another useful fly, a species of Tachinid, is also doing good work in this district. It has also been observed in the field, ovipositing on Tomato Caterpillars. Most of the Tachinid flies are true parasites, feeding within the host.

Damage from Tomato Caterpillar can largely be controlled by hand-picking and by the use of arsenical sprays. Picking off and destroying the infested tomato fruit is of much importance, and, when this is done early, little loss will result from Tomato Caterpillar; infected fruit can easily be seen, and a man or boy can cover a large area in a day's work. Spraying the plants early in the attack with arsenate of lead paste will also be found beneficial. This should be used at a strength of 2 lb. to 50 gallons of water. If the powder form of arsenate of lead is used, 1 lb. to 50 gallons of water will generally be sufficient to destroy the "worm."

SCALE INSECTS—COCCIDÆ.

The following Scale Insects have been obtained in the Stanthorpe district during the period covered by this report:—

Scale Insect.	Host.	Locality.	Damage.
San José (*Aspidiotus perniciosus*)	Plum and apple	Stanthorpe, Applethorpe	Considerable
Soft Scale (*Lecanium Oleæ*)	Pear, apricot, hazel-nut	Thulimba, Applethorpe, The Summit	No appreciable damage
Soft Scale (*Lecanium berberidis*)	Grape vine ..	Amiens, Stanthorpe ..	No appreciable damage

GENERAL.

Throughout the months of February and March, work in the field and the preparation for winter experiments have occupied much of our time. The care, also, of insect life, &c., in the insectary has claimed a certain portion of each day.

ORANGE-PIERCING MOTHS (Fam. *Ophiderinoe.*)*

By HENRY TRYON, Entomologist.

YEAR after year, during the months of March, April, and May, growers of citraceous fruit throughout the coastal districts of the colony, complain of loss that they experience through their round oranges falling after exhibiting the following symptoms:—On one or more faces they present a bruise-like appearance, and within this area of altered tissue occur small circular perforations through which juice very gradually exudes. This may be remarked even when, though full-grown, they are still green, the site of the injury being characterised by a pale-yellow colouration that is very conspicuous on the general green hue of the rind.

This injury, as shown by a botanist residing at Rockhampton, named A. Thozet, as early as 1869, is occasioned by the attacks of large moths of one or more kinds, belonging to the family Ophiderinæ.

THE MOTHS.—These are named *Ophideres fullonica,* Linné; *Mænas salaminia,* Cramer; and *Argadesa materna,* Linné.

They are all alike in that they possess the following family characters, being large robust moths, with stout bodies extending not, or slightly, beyond the hindwings. They have both their thorax and hindbody crested and densely clothed. The eyes are large; the antennæ, or feelers, simple and non-pectinated. The fore and hind wings are strongly contrasted, owing to their different colours. The former are dark-hued, exhibiting dark-olivaceous green, brown, or greyish mauve ground-colour or pattern, whereas the hindwings are always bright orange-yellow and more or less marked with black. The expanse of the forewings is from 2½ inches to nearly 4 inches, according to the sex or species. They are, therefore, both large and conspicuously handsome insects.

Mænas salaminia, Cramer (Plate 72, Fig. 1), unlike the others mentioned, has the outer border of the forewings straight and plane, instead of being arched and scalloped as with them. It is also exceptional in having these organs dark-green with golden reflections, and in having a broad purplish-grey band along the anterior border and a narrow similar band on the outer. In its case both sexes are alike in general appearance.

Othreis fullonica, Linné (Plate 71, Figs. 1 and 2), has the forewings more sharply pointed than are those of either of the other species considered; their external border is, moreover, strongly bowed, though not scalloped (as in *A. materna*). Two lines, also arising at ¼ and ¾ respectively along the fore-border cross the wing-surface and tend to converge on the hind-border, dividing the wing-surface, of rich dark-brown of different shades on a pale mauve-grey ground colour that is here displayed, into well-marked inner, middle, and outer areas. The male (Plate 71, Fig. 2) in this species is readily distinguished from its consort by the more or less uniform livery of its forewings, that are dark ferruginous or vinous brown. Moreover, in the female, the outer of the foregoing lines is toothed or dentate, instead of being evenly curved, and has a white triangular blotch in one of its denticulations pointing inwards; there occurs also a conspicuous sub-triangular dark-brown blotch in the centre of the wing.

* Reprinted from Q.A.J., Vol. II., O.S., pp. 308-15, 1898.

PLATE 71.—*OTHREIS FULLONICA*, LINN.
(Male and Female.)

Plate 72.—*MÆNAS-SALAMINIA*, Fabr.
ARGADESA MATERNA, Linn. (Male and Female).

Argadesa materna, Linné (Plate 72, Figs. 2 and 3). In this insect the forewings are, externally, both arched and scalloped. They are also greenish-grey, covered with olivaceous-brown or purple-brown, transverse, confluent, diminutive stripes; in the centre of the wing also are four purple-black spots (corresponding in position to the triangular dark-brown discal mark of *O. fullonica*). The female (Fig. 3) is distinguished from the male in having the minute stripes of colouration of a deeper colour, and in exhibiting, also on the forewings, beneath the central dark spots, a conspicuous white bar that is directed obliquely outwards.

In both sexes of the three insects the hindwings are orange-yellow with each a broad black marginal band and a black—usually half-moon shaped—central or discal large patch; the former including also a marginal row of white spots. In *Argadesa materna* this marginal band occupies a greater extent of the hindmargin of the wings than it does in the other insects; moreover, the discal patch is rounded instead of being semilunar, as in their case.

THE CATERPILLARS (Plate 73.).—All three insects have caterpillars of similar cylindrical form, measuring two or more inches in length—when fully grown. They have the 11th segment of the body considerably humped. Otherwise they are quite even and smooth. They are unclothed, save for the presence of minute hairs. Like other Noctuæ, they have each eight pairs of legs—viz., three thoracic clawed, and one terminal, and four intermediate unclawed ones—the anterior pair of the last group being rudimentary. In each case also the caterpillars vary in colour at different periods of their growth, but have in common two large spots or ocelli on either side of the body occupying nearly the entire breadth of the 6th and 7th segments. These spots are very conspicuous, being white and often coloured with very marked hues.

In the case of *Ophideres salaminia*, the full-grown larva is, as stated by A. W. Scott, "throughout of a deep rich velvety-black, minutely powdered with small spots of pale-blue and straw-coloured." Moreover, the eye-spot or ocellus is very gaudy, "possessing a black pupil with a blue centre, and an iris yellowish above and saturnine-red below." Further, "the penultimate segment bears a reddish prominence, from which proceeds along each side a delicate tracery of white, resembling the fine fibrous roots of a plant." Examples of this caterpillar are also occasionally of a dull-reddish hue, and exhibit some variation as regards detail in the markings that they present.

The caterpillars of *Othreis fullonica* (illustrated by photo-lithography on Plate 73) are of shades of rich brown, varying greatly in intensity, in different examples, especially such as exhibit diverse ages. They have also numerous small creamy-white black-edged spots and bars, on the upper surface of the body, that tend to coalesce in places. The large eye-spots are, however, as a rule, far less gaily coloured than is the case in *O. salaminia*, being often wholly white and black.

THE CHRYSALIS.—The chrysalis (Plate 74, Fig. 2) is of a very dark-brown colour with usually a purplish cast. It is somewhat roughened anteriorly. Its tail end is blunt, and at its opposite extremity it is obliquely truncated. That of *O. salaminia* may attain a length of nearly an inch.*

RANGE OF OCCURRENCE.—All three insects have a widely extended range of occurrence beyond the confines of the Australian continent.

HABITS.—The eggs are deposited upon the foliage of the plant or plants destined for the support of the caterpillars to which they give rise.

Food Plants.—These food plants comprise several distinct species of Menispermaceæ—twiners with usually large orbicular or ovate-cordate leaves growing as a rule in the scrubs. Local observations, conducted by Messrs. F. P. Dodd, T. Batcheler, and the writer, prove that the following are included in this category. Representations of the foliage of the several ones described, in each case reduced in size, are given on Plate 75:—

(1.) *Pericampylus incanus*, Miers, or Moore's *Cocculus* (as obligingly identified by the Colonial Botanist, F. M. Bailey, F.L.S.), Plate 75, Fig. 4. A widely-extending rampant climber with smooth, bright-green "vines," along the course of which occur alternately, at rather remote intervals, usually large leaves. In the case of the young growth both the stems and leaf-stalks, as well as the leaves—their upper surface especially—are hispid with short erect pale tawny hairs; but these are lost with age, so that the plant becomes ultimately smooth and glabrous.

* Coloured representations of the above-mentioned caterpillars and chrysalises, with more or less full descriptions, are given by F. Moore in "The Transactions of the Zoological Society of London," Vol. XL., Plate XII., Figs. 3, 3a, 36; and by the same authority in Vol. III. of the "Lepidoptera of Ceylon," p. 134, and Plate 161 (1884). Similarly, *O. salamania* is dealt with in A. W. Scott's "Australian Lepidoptera and their Transformations," Vol. II., Part X., pp. 6-7, Plate XI. (1890).

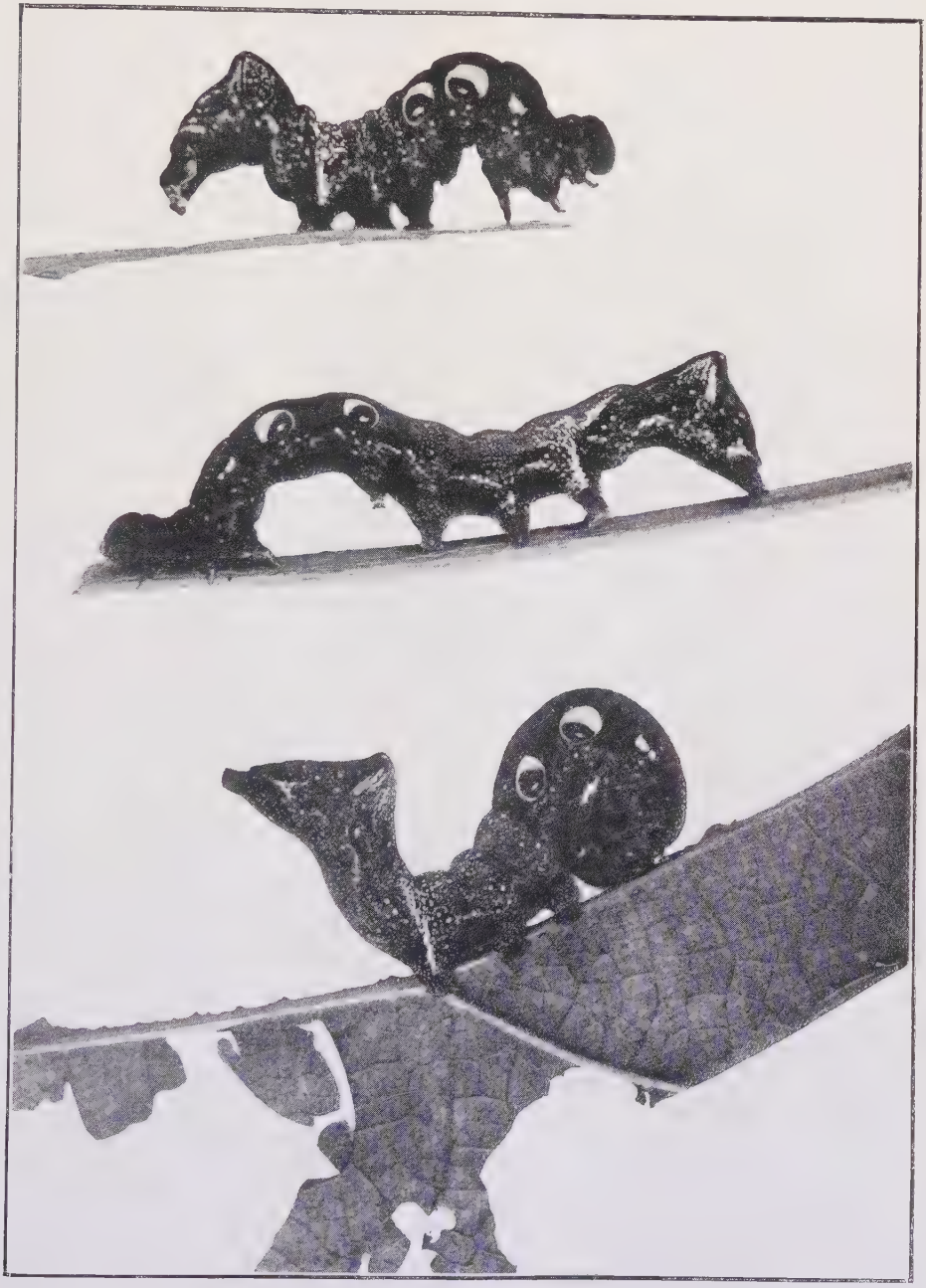

Plate 73.—*OTHREIS FULLONICA*, Linn.

The leaves are provided with leaf-stalks (petioles) from 4 inches to 6 inches in length, and these are suddenly thickened at their points of attachment with the stem. They are broadly ovate—when old sometimes almost orbicular—and apiculate or tipped with little points. Occasionally—especially in young plants—they are excavated or lobed at the base. They may attain a measurement of 7 inches by 6½ inches, but are usually somewhat smaller. Above they are dark glossy-green with paler veins; beneath they are sage-green or glaucous, with the raised veins yellowish-white. These are raised, and radiate from the point of attachment with the leaf-stalk to the margin, being connected with numerous irregular veinlets. The flowers are small, green, and inconspicuous, and occur on branched stalks in the axils of the leaves. The fruit is a red-coloured berry (drupe), measuring 4 to 6 lines in length, and includes a small round compressed stone. This food plant was indicated by T. Batcheler as one to which *O. fullonica* is especially partial. (For a full description the reader is referred to Mueller's "Fragmenta," Vol. I., pp. 162-3; Melbourne, 1858-9.)

(2.) *Stephania hernandiæfolia*, Walp. (Plate 75, Fig. 1). A winding climber that may reach several feet from the ground, when the support of neighbouring bushes is available, but that otherwise forms dense low masses. The stems or vines are slender, brownish hued, and faintly furrowed. The leaves are alternate on the stems and, placed somewhat distantly from one another, are broadly-ovate or almost orbicular, suddenly narrowed to a point at the end, and measuring from 2½ inches to 3½ inches. They have a somewhat fleshy consistence, and their under-surfaces are paler green than their glossy upper ones, and slightly velvety or pubescent, owing to the presence of numerous short whitish hairs. The leaf-stalk is from 2 inches to 3 inches long, peltately fixed—*i.e.*, inserted at a point situated well (usually ¼-inch) within the leaf margin. The primary veins or nerves are raised, and radiate from the point of attachment of the stalk, being from 8 to 10 in number. The flowers are minute, and occur in umbels on short stalks in the axils of the leaves. The fruit is orange-red and smooth, and measures about ¼-inch in length. This plant seems to be especially common on shaded rocky declivities along the sea-coast, where it may form dense masses. (For a full description, the reader is referred to F. Mueller's "Plants Indigenous to the Colony of Victoria," Vol. I., pp. 220-221, Melb. 1860-2, and to more recent publications. It appears also to be the plant figured in A. W. Scott's "Australian Lepidoptera and their Transformations," Vol. II., Part 1, with the designation *Sarcopetalum Harveyanum*).

(3.) *Stephania aculeata*, Bail. "The Prickly-stemmed Stephania." (Plate 75, Fig. 3). This is also a climbing plant, but one of much more slender habit than is *P. incanus*. Its stems and leaf-stalks are armed with thickly-set fine, brownish-coloured spines, each measuring about ⅛ inch in length. The leaves are of a pale-green or bluish-green colour, have rounded lateral angles, and are gradually narrowed towards the tips. They are, moreover, peltate, having the point of attachment of their stems placed some distance (about ¼-inch) within the margin. They may measure from 3 inches by 2½ inches, but are usually smaller. Their veins also have a radiate arrangement. According to F. M. Bailey, the male flowers are minute, and occur in cymes, the hair-like branches of which bear bracts in the axils of the leaves. Both the female flowers and fruit have not hitherto been described. (For a full description, except for the last-mentioned exception only, reference may be permitted to F. M. Bailey's "Contributions to the Queensland Flora," Bulletin 9, page 7; Department of Agriculture, Brisbane, 1891.) Though evidently not an uncommon plant in the scrubs adjacent to Brisbane, its appearance was, it seems, overlooked till November, 1887.

(4.) (*?*) *Tinospora smilacina*, Benth.* (Plate 75, Fig. 2.) A fourth food plant, to which this name is provisionally attached, is figured on Plate XII. It is of more slender habit than either of the others described, and the 5-nerved leaves are longer. The material available for description is, however, meagre, and cannot be immediately supplemented. J. G. Luehmann stated regarding it, and having the material figured alone before him—"As you correctly observe, it looks like a Menispermaceous plant (though it may be something else). . . . It greatly resembles *Tinospora smilacina*, but that plant does not extent as far south as Moreton Bay, and has, as a rule, blunter leaves."

The caterpillars (as also shown in the photographic illustration embodied in Plate 73.) when at rest assume many strange attitudes. They may support themselves from one or other extremities of the body, or even hold the head and tail up at the same time. When resting on their abdominal feet, moreover, they are wont to curve their head under so that its top may come in apposition to their chest.

* The discovery of this plant as a food plant of *Othreis fullonica* is due to F. P. Dodd, to whose extensive knowledge of the Lepidopterous fauna of Queensland the writer is under many obligations.

Plate 74.—*OTHREIS FULLONICA*, Linn.
(Chrysalis in leaf and isolated.)

PLATE 75.—FOLIAGE OF FOOD PLANTS OF ORANGE MOTHS.

When molested they may successively assume different attitudes, jerking their bodies to one side or the other; or, as usually happens, throw themselves to the ground. They are somewhat voracious feeders, and individual specimens will partake of several different species of Menispermaceous plants without apparent detriment to their vitality. According to the observations of T. Batcheler, it would appear that many become full grown ("full fed") in about three weeks from the time of hatching.

When this event has happened, the caterpillar fastens adjacent leaves of its food plant together, or fragments of these, and, within the enclosure thus obtained, spins a very delicate cocoon of white silk, attaches itself by its tail, and then passes into the chrysalis state (*vide* Plate 74, Fig. 1). About three weeks elapse before the moth emerges from its chrysalis.

The last-mentioned observer is of opinion that the insects, or at least *O. fullonica*, pass the winter as moths, since he has met with much faded—evidently, therefore, old—specimens about as early as September; and that the hibernated females, laying their eggs in spring, give rise to the small brood that is to be met with in South Queensland in November and December. T. Batcheler also states that after December there is a succession of broods until May, straggling examples occurring up till the 18th of that month. They are very strong fliers, and pass with facility over long distances in quest of food for themselves or of the plants on which to lay their eggs. Thus P. McLachlan records having taken *A. materna*, Linn., at sea 300 miles from Mauritius, the nearest land (Proc. Ent. Soc. Lond. 1877, page 5).*

According to the observations of T. Batcheler, both *O. fullonica* and *Mænas salaminia* are on the wing principally between the hours of dusk and 11 p.m.† What is the term of existence of the perfect insect is not known, but it has been remarked by the writer that the same insect may occur at night in the same spot during a period of several days. Though they may travel in the first instance long distances to attain food that is provided for them, and thus a far distant growth of a Menispermaceous food plant serve to afford pests for fruit trees close at hand, there are grounds for concluding that having once reached this goal they are addicted to remain in its neighbourhood for some time, since they have been observed sheltered in dry brushwood in the neighbourhood of orchards, and where they could not have originated. On the other hand, orchards that adjoin scrubs in which Menispermaceous plants occur—and whence it may be inferred the moths emanate—suffer as a rule to a greater extent from the special depredations that they occasion than do others that have no such environment.

The habit of the moths, however, which has led to this communication, is that of boring with their horny probosces, or antilia, through the rind of the ripe or ripening orange for the purpose—that they thus accomplish—of imbibing the juice of the fruit. Several not infrequently alight on a single orange with this object, and are to be observed with their probosces still inserted deep into the rind, so that their capture may be readily accomplished. As a result of these injuries, that in great part consist in air being admitted to the fruit-pulp beneath the rind, the orange drops to the ground and quickly rots.

Some have denied, as is more particularly set forth in the concluding section of this article (*vid.* p. 396), that these moths perforate the fruit themselves, as they regard this action on their part as a physical impossibility. On the other hand, they assert that the moths, though they visit the fruit and imbibe its juices, yet avail themselves of the holes that have been already made by other insects, and thus suck the juice through channels in whose preparation they have taken no part. The only insects, however, that have been specifically mentioned as probable precursors of these attacks are the ordinary Fruit Fly and an orange-frequenting Green Plant Bug with thornlike expansions on each side of its thorax—a species of *Rhynchocoris*. The latter, however, restricts its attention to green immature fruit, which it certainly probes; and the former, or Fruit Fly, though it may no doubt occasionally act

* This facility for making long excursions, coupled with the general partiality of their caterpillars for several different plants comprised within a single order—*i.e.*, Menispermaceæ—coupled with the fact that such plants themselves have a wide extra-Australian range of occurrence (*Stephania hernandiæfolia* being found, according to Messrs. G. Bentham and F. Mueller, "from Eastern Africa, almost all over India and the Archipelago, and northward to China," and *Pericampylus incanus*, also, being "common in Eastern India, India, and the Malayan Archipelago, extending northward to South China"—*vid.* "Flora Australiensis," Vol. I., pp. 56 and 58), explains the fact that the species of Ophiderinæ that are met with in Queensland also occur in several far distant lands.

† However, the moths are not attracted by light.

in the capacity referred to, and the moth avail itself of a means of access to the juice of the fruit that it has provided, does not invariably do so, for it generally happens that damaged fruit harbours neither eggs nor fly-maggots, a fact ascertainable by direct observation, and inferred from the circumstance that fruit flies cannot invariably or even often be reared from damaged fruit, which would be otherwise were the ovipositor or egg-placer of the fly the exclusive agent in making the perforation.

As concerning the allegations that it is a physical impossibility, it should be borne in mind that F. Moore, the able monographer of the Ophiderinæ, whilst referring to the exercise of this habit in *Othreis fullonica*, does not express any doubt regarding the accuracy of the observations that have given rise to the narrative that he quotes; nor, indeed, does he question the ability of the moth itself to perform the mechanical operations that such depredations as have been attributed to it involve. Moreover, the curious and exceptionally formed proboscis (or applied maxillæ) has been shown by a French naturalist, J. Künckel d'Herculais, not only in the case of *Othreis fullonica*, but also in those of *A. materna*, *M. salaminia*, and *O. imperator*, as well as other species, to be specially and exceptionally adapted to *this end*.*

This proboscis, or antilia, is made up of two applied maxillæ, and about one-eighth part of its length is occupied by the teretron or borer. This is a double organ, consisting of two similar halves. One of the halves, or what really is the end of a maxilla, is thus described by Dr. R. B. Read, of Sydney, whose account of it is here given to escape the generally undesirable act of translating an author's description, as would have been necessary in making use of Künckel d'Herculais' memoir; and since it is most accurate with regard to detail:—

Upper and Outer Surface.—Tip acutely pointed, expanding upwards into three barbs, two of which, the first and third, are placed on the outer side, whilst the second is intermediate between them, and next the line of junction with the maxillæ. From the barbed portion the terminal begins to expand, and on its upper surface is presented, in a line above the second barb, a curved projection terminating abruptly, showing a sharp oval gauge-like edge; the interior of the projection is sharply hollowed out, and from it arises a large rounded tooth-like process. From this point commence two or more rows of thickly-set setæ, which continue the whole length of the antilia (the two applied maxillæ, or proboscis). Above and on the outer side of the terminal is placed, diagonally, a second process similar to that already described, whilst above in a line between the first and second, occurs the third. The fourth is placed above, and in a line alternating between the second and third. The fifth is similarly placed in relation to the third and fourth; and the sixth and last in respect of the fourth and fifth. Each superior process is slightly larger than that below it. At the base of the sixth process, in a slightly cupped hollow, is a solitary long spine, whose office may be to prevent the teretron being plunged too deeply into fruits to permit of withdrawal.

Under Surface.—Tip acutely pointed, expanding upwards, then suddenly contracting, gives a sharp transverse ridge one half-way up the barbed portion, which again expands upwards and outwards and forms a second sharp-edged transverse ridge. The remainder of the terminal is divided unequally into three divisions, each of which presents a very strong, sharp, lancet-like process. At the junction of the terminal with the remainder of the maxillæ are set diagonally upwards and outwards four conically-shaped spines; then, a space intervening, there is placed higher up the maxillæ a set of three similar spines; after a longer interval a set of two spines occurs, and finally a single spine is placed at a considerable distance from the last two, making ten in all placed like the teeth of a long harrow.

Furnished with this extraordinary apparatus (Dr. Read concludes) these species of Ophideres are able to pierce the skin of the orange even before it has turned yellow, two of them sometimes attacking the same fruit.†

Having seen, then, with how perfect a boring apparatus these moths are provided, it would seem highly probable on *a priori* grounds, were no observations as to the manifestation of the habit forthcoming, that they would not adopt exclusively the procedures referred to in gaining access to the juice of the orange, but might

* Les Lepidopteres, à trompe perforante, destructeurs des oranges. Compt. Rendus, 61, Paris, 1875, pp. 397-400, and Plate.

† Read (Dr. R. B.). "Lepidoptera having the Antilia terminated in a Teretron or Borer." Proc. Lin. Soc. N.S. Wales, Vol. III., 1879, pp. 150-154, accompanied by a carefully-executed Plate.

rather oftentimes perforate its investing rind; that when an individual moth found no previous channel into the pulp, or, in the case of several moths simultaneously visiting a fruit, a sufficient number, it would bring the borer into requisition.

Insects might, perhaps, be mentioned that are endowed with more efficient penetrating organs than are those of the species of Ophiderinæ; but then, conjoined with evidence of the possession of these is required, from those who deny that moths can perforate fruit, proof that these specially favoured insects, on their part also, manifest this habit. But of the insects that seek admission to the pulp of the orange as directly affording them food, or as furnishing a nidus in which to deposit their eggs, the writer knows of none as competent as are the so-called orange moths to effect a passage through the rind.

In Queensland these moths do not confine their attention to oranges. Some seasons back it was reported that at Glen Prairie, near Rockhampton, a moth, that proved to be *Ophiderces fullonica*, was making great havoc amongst the mango fruit, by alighting on it and extracting its juice. From other parts Orange Moths are reported as damaging bananas in a similar manner. In the vicinity of Brisbane, at a time when ripening oranges are only exceptionally, if ever, to be found, the writer has seen these moths amongst grape-vines loaded with ripe fruit, and, as elsewhere remarked by him, the ready way in which some grapes, notably the Black Hamburg, shed their fruit may be possibly ascribed in some cases to the fact that Orange Moths have visited the bunches.

For further information on this subject reference may be made to an elaborate paper contained in the "Quarterly Journal of the Microscopical Society," Vol. XI., 1875, entitled "On the Structure of the Proboscis of *Ophiderces fullonica* or Orange-sucking Moth." In this F. Darwin not only recites A. Thozet's observations, but also gives a *resumé* of an article by ——. McIntyre published in the "Monthly Microscopical Journal," of May, 1874, on boring Lepidoptera of the Cape of Good Hope, the proboscis of one of which resembles, as is stated, to some extent that of *O. fullonica* described and figured by M. Künckel, and is competent to penetrate the skin of the hand when attempt is made to grasp the insect possessing it.

Remedies.—(1.) By means of the cane or scrub knife cut off at the roots all plants which it may be concluded, by direct observation, support the caterpillars, or moths in their immature state, or that may be identified with food plants from the descriptions previously given (pp. 390 and 393), and growing in scrubs or on rock banks in the vicinity of orange orchards, and destroy at the same time whatever caterpillars or chrysalises may be thus encountered.

(2.) Where it is practicable, and economically justifiable, destroy the entire woody vegetation where such food plants may be expected to exist.

(3) Remove all brushwood from the vicinity of orange orchards, that the moths may have little or no harbouring places in the intervals between their nocturnal visitations.

(4.) Afford, if practicable, a counter-attraction; and capture or net the moths thus diverted from pursuing their destructive work. They are especially partial to highly flavoured bananas of the Cavendish type. Thus, suffer to remain on one or two of the latter plants, if growing conveniently, as many bunches; till the over-ripe fruit drops to the ground. Or, preferably, hang in places that can be conveniently visited, wrapped in calico, small bundles containing similarly conditioned fruit of this descripton—five or six bananas in each. These to be nightly visited with lantern and net in hand, when the not-readily-disturbed Orange Moths amongst others may be captured.

(5.) Poison the moths by impregnating the bananas with a syrup containing a small proportion of arsenite of potash made by boiling equal weights of white arsenic (arsenious acid) and bicarbonate of potash in water. Sixty-four grains of each of the chemicals named to 4 oz. of water form convenient proportions for the manufacture of the poison.

It must, however, be borne in mind that the best results may be obtained by beginning operations long before the season for oranges commences. From what has been already stated (*vid.* p. 393) the early broods of the insect—viz., those that occur before the end of December—are comparatively small, but from them arise, by accessions with the birth of each successive brood, the very large numbers that visit orangeries notorious for injury to their fruit of the nature described.

Historical.—The subjoined statement, since it serves to show the part played by one of Queensland's pioneer and ablest scientific workers in elucidating the facts narrated, and also bears upon the subject dealt with, may be not altogether devoid of interest to those who may feel induced to further prosecute this inquiry.

The fact that one of the moths mentioned—viz., *Ophideres fullonica*—injured oranges in the manner described was discovered as early as 1869 by A. Thozet, a French botanist resident at Rockhampton, and recorded by him in the Rockhampton *Bulletin* of that year. In 1871 he further made this known to Mons. J. Künckel d'Herculais, assistant naturalist at the Paris Museum of Natural History, accompanying his statement with illustrative examples of the insect concerned. Again, in May, 1875, the destructive rôle enacted by these insects was again enlarged upon by A. Thozet in a communication over the signature "Pomona," appearing in the Rockhampton *Bulletin* of — May and the *Capricornian* of 8th May.

The well-known Queensland lepidopterist, W. H. Miskin, disputed this finding in a letter "On Insect Enemies of the Orange," printed in the *Queenslander* of 22nd May, 1875. To this "Pomona" furnished an able reply, dated 10th June, 1875, that appeared in the Rockhampton *Bulletin* of that month.

This controversy between A. Thozet and W. H. Miskin, in 1875, having been in due course brought under notice of d'Herculais, he was now induced to again consider the former's allegations, and, as part of his inquiry, to examine the proboscis or sucking organ of the moth to which it referred. This renewed investigation on his part then brought to light the marvellous and exceptional structure that it exhibited, and that seemed to answer so well to the function of piercing comparatively hard substances that had been attributed to it by Thozet. This he made known in a special memoir entitled "Les Lepidopteres, à trompe perforante, destructeurs des oranges," that was communicated by Emile Blanchard to the French Academy of Sciences, on 3rd August, 1875, and printed in the annals of that society (*vid. Compt. Rendus* 61, Paris, 1875, pp. 397-400, and Plate).

F. Darwin also on his part described this strangely fashioned piercing organ of *Ophideres* in the "Quarterly Journal of Microscopical Science" for 1875, and wrote on 22nd August to A. Thozet, "congratulating him on his discoveries," remarking that they supported his own observations on the habits of *Phalenes* that perforated the nectaries of certain flowers.

M. Künckel d'Herculais' paper, that created very great interest amongst scientific men, is reprinted in the "Annals and Magazine of Natural History" for 1875 (*vid.* 4 Series, Vol. XVI., pp. 372-4, 1875), and also summarised in the "Gardeners' Magazine" for the same year. It was also incorporated in an able paper read before the Paris Acclimatisation Society by Mons. Aime Dufort shortly afterwards. Dufort's paper has been made known to Australian readers, for, having been translated into English by the editor of this *Journal*, A. J. Boyd, and communicated to the *Queenslander*, it appeared in its issues of 14th July and 21st July, 1877.

Prior, however, to the important discovery being made known in the colony, another Rockhampton correspondent (G. L. Pilcher) had also publicly disputed A. Thozet's contention, in a letter dated 23rd March appearing in the *Queenslander*, 7th April, 1877; and his views on this subject, having been meanwhile communicated to a well-known British entomologist, found expression also in "Cistula Entomologica" of 1877, pp. 237-40.

W. H. Miskin, as referee to the *Queenslander* on entomological topics, again impugned the accuracy of A. Thozet's observations in the *Queenslander* of 11th May, 1878, without comment, however, on the confirmatory discoveries on the part of d'Herculais and F. Darwin. Thozet, however, found a local champion in Robert Grieve, who also wrote to the *Queenslander* on "The Enemy of the Orange," narrating similar observations made in the vicinity of Brisbane to those that the former had made at Rockhampton.

In 1879 Dr. R. B. Read, of Sydney, published his independent researches on "Lepidoptera having the Antilia terminated in a Teretron or Borer," in a paper, already quoted, read before the Linnean Society of New South Wales, and appearing in Vol. III. of its "Proceedings" (*op. cit.*, pp. 150-154, 1879). In this appears an excellent figure of the distal extremity of the proboscis of *Ophideres fullonica* and *O. salaminia*.

Again, the present writer discussed the whole subject fully in 1889, in an article entitled "Orange Moths—Fam. Ophiderinæ," appearing in his Report on Insect and Fungus Pests (*op. cit.*, pp. 101-104, Brisb., 1879).

Finally, the same theme is briefly dealt with from another point of view by A. Sidney Olliff and H. Forde in A. W. Scott's "Australian Lepidoptera and their Transformations" (*op. cit.*, Vol. II., Part I., pp. 6-7, 1890).

DESCRIPTION OF PLATES.

PLATE 71.—*Othreis fullonica*, L. Male and female. (Original.)

„ 72.—*Mœnas salaminia*, Cram., and *Argadesa materna*, L. Male and female. (Original.)

„ 73.—*Othreis fullonica*, L. Caterpillars from life. (Original.)

„ 74.—*Othreis* chrysalis. Natural mode of occurrence and isolate. (Original.)

„ 75.—Foliage of Menispermaceous food plants of Ophiderinæ. Dimensions reduced. (Original.)

(1) *Stephania hernandiæfolia*, Walp.
(2) (?) *Tinospora smilacina*, Benth.
(3) *Stephania aculeata*, Bail.
(4) *Pericampylus incanus*, Miers.

PLATE 76.—SUGAR-CANE GROWING ON MR. H. SANDERSON'S FARM, NORTH DEEP CREEK, GYMPIE, PHOTOGRAPHED SIX MONTHS TO THE DAY AFTER PLANTING.

It is Hambleton Seedling Variety.

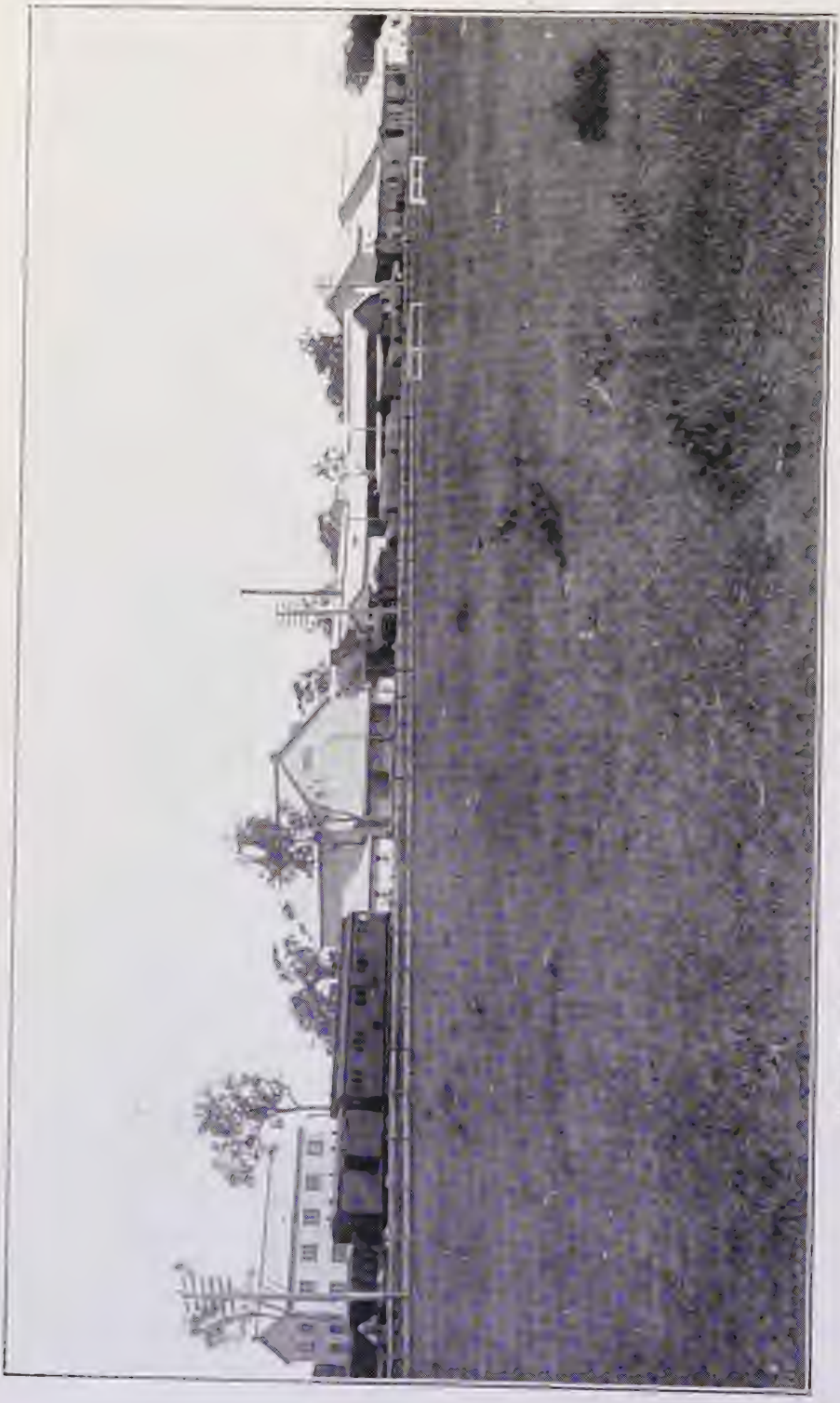

PLATE IV.—COTTON GROWING AND COTTON SEED OIL MILL, WHINSTANE, BOONAH.

General Notes.

Native Bears and Opossums—Close Season Extended

The close season for native bears and opossums has been extended, and will now end on the 30th April, 1925, instead of on the 30th April, 1924.

The Pink Boll Worm.

The Acting Minister for Agriculture (Hon. W. Forgan Smith) has announced the adoption of an Order in Council declaring that the Pink Boll Worm is a pest in any district in Queensland, and that the presence of the Pink Boll Worm in or about any cotton plant is a disease under the Cotton Industry Act.

Staff Changes and Appointments.

The resignation of Mr. R. J. S. Muir, Canegrowers' Representative on the South Johnstone Local Sugar Cane Prices Board, has been accepted, and Mr. G. F. Hudson appointed in his stead.

The resignation of Mr. A. B. Clarke, Canegrowers' Representative on the Marian Local Sugar Cane Prices Board, has been accepted, and Mr. J. J. Hedrick appointed in his stead.

Police Constable G. R. Spencer has been appointed an Acting Inspector of Stock.

The appointment of Mr. R. R. Anson as Assistant Instructor, Cotton Section, Department of Agriculture and Stock, has been confirmed as from the 4th October, 1923.

Cane Pest Boards.

The Plane Creek Cane Pest Board has now been constituted as under:—Millers' representatives: Messrs. A. Innes and J. C. Nicholson; canegrowers' representatives: Messrs. S. F. Dent, R. A. McKie, and A. Patterson.

Messrs. C. D. Clarke, J. T. O'Riordan, F. J. Stevens, G. F. Williams, and R. G. Johnson have been nominated as canegrowers' representatives for the Mackay Cane Pest Board, and as the number exceeds the number to be elected—viz., three—a poll will be taken on the 15th May, 1924, closing at 12 o'clock noon.

Registered Co-Operative Companies.

A notice has been issued declaring the following companies to be companies in accordance with "*The Primary Producers' Co-operative Associations Act of* 1923":—

Palmwoods, Montville, & Buderim Amalgamated Fruitgrowers' Society, Limited;

Stanthorpe Co-op. Canning, Jam, & Preserving Coy., Ltd.;

Pikedale Soldiers' Settlement Co-op. Canning, Jam, & Preserving Coy., Ltd.

Queensland Co-operative Fruit Products Ltd.; and

Woombye Fruitgrowers', Limited;

and Regulation 56 under the Act fixes the date of meeting of such companies as Saturday, the 10th May, 1924.

Sugar Assessment Levy.

In accordance with the provisions of the Sugar Experiment Stations Act, the Secretary for Agriculture and Stock has levied an assessment at the rate of one half-penny on every ton of sugar-cane received at sugar-works during the season 1924-25, such assessment to be payable by the owners of sugar-works in the first instance, and an Order in Council under the Regulation of Sugar Cane Prices Acts has been approved, ordering that the assessment which the Minister may make and levy on every ton of sugar-cane received at any mill on and after the 1st May, 1924, is fixed at the sum of twopence per ton.

Messrs. J. H. Cattermull and A. L. McColl have been appointed millowners' representatives on the South Johnstone Local Cane Prices Board, *vice* G. R. Blair and J. J. Cran, appointments rescinded.

Mr. Marmon Devine, of Daymar, S.W. Line, has been appointed an Honorary Inspector of Stock, as from the 5th April, 1924.

Atherton Maize Pool.

The constitution of the Atherton Tableland Maize Pool Board has now been altered. Instead of members holding office for one year only, thus necessitating a complete re-election annually, it is now provided that members remain in office for two years, a section of the Board being elected each year. The three representatives who gain the highest number of votes at the 1924 election will remain in office until 31st March, 1926, but the two representatives obtaining the next highest number of votes are to be appointed for one year only. Two representatives shall be elected in 1925, 1927, 1929, and 1931, each for two years; and three representatives in 1926, 1928, and 1930, also for two years. In 1932 the three members elected will hold office until 30th June, 1933.

Mr. A. B. Tanner, Nambour, has been appointed an Honorary Inspector under and for the purposes of the Diseases in Plants Act.

The resignation of Mr. R. G. Patullo, Inspector under the Diseases in Stock Act at Kingaroy, has been accepted.

The resignation of Mr. Jas. A. Clarke, Inspector under "*The Diseases in Plants Act of* 1916," has been accepted as from the 30th April, 1924.

Proposed Queensland Maize Board.

A recent *Gazette* notice states the intention of the Governor, in pursuance of the provisions of the Primary Products Pools Act, to create a Queensland Maize Board. This Maize Board has been recommended by the Council of Agriculture and, if formed, it will be briefly constituted as follows:—

It will take in all maize produced from seed soon after the 1st July, 1923, in any part of Queensland other than the Petty Sessions Districts of Atherton, Herberton, and Chillagoe, which are already attended to by the Atherton Tableland Maize Pool.

The Pool will be in operation for one year from the actual date of constitution and for such extended period not exceeding five years as the Governor in Council (on the recommendation of the Council of Agriculture) may decide.

The Board to administer the Pool will consist of five members together with a person to represent the Council of Agriculture.

In order that there may be no delay in getting the Pool (if constituted) into working order, a Provisional Board is provided. This will consist of—

Messrs. T. F. Plunkett and T. C. Haynes to represent the No. 1 District, which will comprise the Pastoral District of Moreton.

Messrs. B. C. C. Kirkegaard and J. T. Chamberlain, to represent the No. 2 District, which will comprise the Pastoral Districts of Darling Downs and Maranoa.

Mr. J. H. Sigley to represent the No. 3 District, comprising the rest of Queensland with the exception of the Petty Sessions Districts of Atherton, Herberton, and Chillagoe.

The above Provisional Board will hold office until the 31st July, 1924, and in the meantime provision has been made for the election of representatives for the three abovementioned districts.

Nominations for membership on the Board should reach the Under Secretary, Department of Agriculture and Stock, Brisbane, before the 31st May, 1924. The Board thus elected will hold office for twelve months from the 1st August, 1924.

Persons eligible to vote on any referendum or election in connection with the proposed Board subsequent to the 1st July, 1923, and prior to the 31st July, 1924, shall be persons growing at any time subsequent to the 1st July, 1923, maize for grain in any part of Queensland other than the Petty Sessions Districts of Atherton, Herberton, and Chillagoe.

At future referendums or elections the eligible voters shall be persons who grew maize for grain at any time during the twelve months preceding the date of such referendum or election in any part of Queensland, exclusive of the Atherton Tableland as above.

A petition has already been received asking that a ballot be taken to decide whether the Pool shall be created, and the necessary referendum papers are being despatched to growers this week. They must be returned to the Under Secretary, Department of Agriculture and Stock, Brisbane, so as to reach him not later than the 31st May, 1924. Any grower entitled to vote who does not receive a ballot-paper is invited to send his name at once to the Department of Agriculture and Stock, Brisbane.

Close Season for Quails.

The close season for quails will now end on the 31st May instead of the 30th April, 1924, as previously notified.

Ratoon Cotton.

Up to the 16th June, 1924, every grower shall be at liberty to harvest all ratoon cotton and standover cotton on land under his control and dispose of such cotton on the following conditions:—

For the said ratoon or standover cotton an advance of threepence per pound will be made by the Government if the cotton is clean and free from leaf and stain: provided the grower shall have before the 30th June, 1924, destroyed all ratoon and standover cotton plants on his land. Full particulars of such ratoon and standover cotton must be sent to the ginnery to which it is consigned at the time of despatch, and any ratoon or standover cotton found to be mixed with annual seed cotton in any consignment will entail the rejection of the whole consignment. The Department of Agriculture and Stock will arrange the sale of lint from ratoon cotton and standover cotton upon owner's account, and pay him any excess received over the 3d. a pound, less cost of ginning and marketing.

Every grower, before the 30th June, 1924, must destroy all ratoon and standover cotton plants on his land. After the 30th June, 1924, an inspector shall enter all lands on which ratoon or standover cotton plants remain, and destroy such plants at the expense of the grower. No person shall have any claim for compensation in consequence of such entry and destruction.

Compensation for ratoon bolls or standover bolls which are immature and unmarketable on the 16th June, 1924, may be based upon the difference between the net amount received by the grower for ratoon cotton and standover cotton harvested and disposed of before the 16th June, 1924, and a fair estimate of the net amount which the grower would have received for his crop had he been allowed to continue to harvest up to the 31st July, 1924. The actual amount of such compensation shall be determined by the Secretary for Agriculture and Stock, but no compensation shall be paid except to a grower who has faithfully complied with the terms of this Order.

Every grower having ratoon cotton must, within fourteen days after the making of this Order, furnish the Department of Agriculture and Stock, Brisbane, with the following particulars:—

Whether he is the owner or lessee of the land on which the cotton is grown;

What use was made of such land prior to the planting of the crop;

The area under plant cotton;

The area under ratoon or standover cotton;

The total area under cotton cultivation;

The quantity of all ratoon cotton and standover cotton already harvested during 1924;

The estimated weight of unharvested ratoon and standover cotton;

Whether stock had been allowed access to his cotton crops and, if so, on what dates;

The state of the land—whether properly cultivated or overgrown with weeds; and

Any other information that may enable the Department to decide the question of compensation.

Any person committing a breach of the Order will be liable to a penalty of £100.

Bunchy Top Investigations.

Since a previous communication concerning the progress of the arrangements with the Commonwealth Government through the Science and Industry Institute and New South Wales respecting arrangements for the investigation into the Bunchy Top disease, advice has been received by the Minister for Agriculture and Stock (Hon. W. N. Gillies) that Mr. McGee, one of the scientists recommended by the committee representing the co-operation, will accept the appointment, and will shortly arrive in Brisbane. The way is now cleared for the commencement of the investigation under the supervision of Professor Goddard, who will, in addition to Mr. McGee, have Mr. Collard of the Department of Agriculture on his staff.

Bunchy Top Investigation.

In the course of a recent announcement, the Minister for Agriculture (Hon. W. N. Gillies) said that at the meeting in February last in Brisbane relating to the investigations into the Bunchy Top disease, Professor Watt, of the Sydney University, Professor Osborn, of the Adelaide University, and Professor Goddard, of the Queensland University, discussed and made recommendations as to the best methods of research. They proposed, among other things, that two scientists be invited to undertake the investigation, but it has been ascertained since that neither gentleman is available; from inquiries abroad it seems that there is a dearth of first-class scientific men available for research work.

At a recent meeting in Brisbane, Sir G. H. Knibbs (Director of the Commonwealth Bureau of Science and Industry), Mr. G. Valder (Under Secretary for Agriculture, New South Wales), Professor Goddard (Queensland University), and Mr. E. G. E. Scriven (Under Secretary for Agriculture) discussed the situation. At a later meeting in Sydney it was decided, subject to the agreement of the Governments of Queensland, New South Wales, and the Commonwealth, that the investigation should be placed with this State, under the supervision of Professor Goddard.

A junior scientist is to be appointed. Mr. Collard, of the Fruit Staff of this Department, has been seconded for service as horticulturist for the research work, and also for any departmental help that can be given. Details have, of course, to be arranged, but now the way is clear no time will be lost in commencing active work. Mr. Collard will visit Fiji to observe conditions there.

Co-operative Associations Act.

A notice under section 24 of "*The Primary Producers' Co-operative Associations Act of* 1923" has been issued declaring a further number of companies carrying on operations of a co-operative nature in relation to primary produce, and a regulation (No. 57) has been promulgated under that Act, requiring such companies to hold meetings on or before the 17th May next.

Co-operative Associations Act—Additional Regulations.

Additional Regulations Nos. 54 and 55 have been issued under "*The Primary Producers' Co-operative Associations Act of* 1923" providing that (54) all associations which signified, prior to the 6th March, 1924, by the production of documents, their intention of becoming registered under the abovenamed Act, shall be accepted for registration on payment of the prescribed fee; and (55) subclause (2) of clause 41 of the Regulations published on the 6th March, 1924, be rescinded and that a subclause be substituted therefor, setting out that persons who have practised as public accountants or persons with experience in auditing accounts, subject to the approval of the Auditor-General, may be appointed as auditors for associations.

Messrs. S. Stevens and P. J. O'Donnell, Land Rangers, Dalby, and Mr. A. H. T. Bedford, Curlew street, Toowong, have been appointed Inspectors, Advances to Settlers Branch, State Advances Corporation, and Mr. F. W. Haynes, Land Ranger, Gayndah, has been seconded to and appointed Acting Inspector, Advances to Settlers Branch, State Advances Corporation, for a period of six months.

Mr. G. Rankin has been appointed an officer under and for the purposes of "*The Animals and Birds Act of* 1921," as from the 10th April, 1924.

Mr. W. Lazenby has been appointed an Honorary Inspector under and for the purposes of "*The Diseases in Plants Act of* 1916," as from the 10th April, 1924.

The resignation of Mr. C. Sheehy, Record Clerk, Department of Agriculture and Stock, has been accepted as from the 29th February, 1924. Mr. Sheehy is now the Assistant Secretary of the Council of Agriculture.

Mr. C. R. H. Jacobson, Temporary Inspector of Dairies, Department of Agriculture and Stock, has been appointed Inspector under the Dairy Produce Act, Department of Agriculture and Stock, as from the 12th April, 1924.

Farm and Garden Notes for June.

Field.—Winter has set in and frosts will already have been experienced in some of the more exposed districts of the Southern Coast and on the Darling Downs. Hence insect pests will to a great extent cease from troubling and weeds will also be no serious drawback to cultivation. Wheat sowing should now be in full swing, and in connection with this important operation should be emphasised the necessity of at all times treating seed wheat by means of fungicides prior to sowing. Full directions for "pickling" wheat by the Bluestone and Lime treatment are available on application to the Department of Agriculture, Brisbane. Land intended for the production of early summer crops may now receive its preliminary preparation, and every opportunity taken advantage of to conserve moisture in the form of rainfall where experienced; more particularly so where it is intended to plant potatoes or early maize. Where frosts are not to be feared the planting of potatoes may take place in mid-July; but August is the recognised month for this operation. Arrowroot will be nearly ready for digging, but we would not advise taking up the bulbs until the frosts of July have occurred. Take up sweet potatoes, yams, and ginger. Should there be a heavy crop, and consequently a glut in the market, sweet potatoes may be kept by storing them under cover and in a cool place in dry sand, taking care that they are thoroughly ripe before digging. The ripeness may be known by the milky juice of a broken tuber remaining white when dry. Should the juice turn dark, the potato is unripe, and will rot or dry up and shrivel in the sandpit. Before pitting, spread the tubers out in a dry barn or in the open, if the weather be fine. In pitting them or storing them in hills, lay them on a thick layer of sand; then pour dry sand over them till all the crevices are filled and a layer of sand is formed above them; then put down another layer of tubers, and repeat the process until the hill is of the requisite size, and finally cover with either straw or fresh hay. The sand excludes the air, and the potatoes will keep right through the winter. In tropical Queensland the bulk of the coffee crop should be off by the end of July. Yams may be unearthed. Collect divi-divi pods. The opium poppy will now be blooming and forming capsules. Gather tilseed (sesame). Sugar-cane cutting may be commenced. Keep the cultivator moving amongst the pineapples. Gather all ripe bananas.

Cotton crops are now fast approaching the final stages of harvesting. Growers are advised that all cotton in the Central District should be consigned to the Australian Cotton-growing Association, Rockhampton or Gladstone, whichever is nearest; whilst those in the Southern areas should consign their cotton to the Association at Gayndah or Whinstanes, near Brisbane. All bales and bags should be legibly branded with the owners' initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus the address labels.

Kitchen Garden.—Cabbage, cauliflower, and lettuce may be planted out as they become large enough. Plant asparagus and rhubarb in well prepared beds in rows. In planting rhubarb it will probably be found more profitable to buy the crowns than to grow them from seed, and the same remark applies to asparagus.

Sow cabbage, red cabbage, peas, lettuce, broad beans, carrots, radish, turnip, beet, leeks, and herbs of various kinds, such as sage, thyme, mint, &c. Eschalots, if ready, may be transplanted; and in cool districts horse radish can be set out.

The earlier sowings of all root crops should now be ready to thin out, if this has not been already attended to.

Keep down the weeds among the growing crops by a free use of the hoe and cultivator.

The weather is generally dry at this time of the year, so the more thorough the cultivation the better for the crops.

Tomatoes intended to be planted out when the weather gets warmer may be sown towards the end of the month in a frame where the young plants will be protected from frost.

Flower Garden.—No time is now to be lost, for many kinds of plants need to be planted out early to have the opportunity of rooting and gathering strength in the cool, moist spring time to prepare them for the trial of heat they must endure later on. Do not put your labour on poor soil. Raise only the best varieties of plants in the garden; it costs no more to raise good varieties than poor ones. Prune closely all the hybrid perpetual roses; and tie up, without pruning, to trellis or stakes the climbing and tea-scented varieties, if not already done. These and other shrubs may still be planted. See where a new tree or shrub can be planted; get these in

position; then they will give you abundance of spring bloom. Renovate and make lawns, and plant all kinds of edging. Finish all pruning. Divide the roots of chrysanthemums, perennial phlox, and all other hardy clumps; and cuttings of all the summer bedding plants may be propagated.

Sow first lot, in small quantities, of hardy and half-hardy annuals, biennials, and perennials, some of which are better raised in boxes and transplanted into the open ground, but many of this class can, however, be successfully raised in the open if the weather is favourable. Antirrhinum, carnation, picotees, dianthus, hollyhock, larkspur, pansy, petunia, *Phlox Drummondi*, stocks, wallflower, and zinnias, &c., may be sown either in boxes or open beds; mignonette is best sown where it is intended to remain. Dahlia roots may be taken up and placed in a shady situation out of doors. plant bulbs such as anemones, ranunculus, freesias, snowflakes, ixias, watsonias, iris, narcissus, daffodils, &c. Tulips will not suit the Queensland climate.

To grow these plants successfully, it is only necessary to thoroughly dig the ground over to a depth of not less than 12 in., and incorporate with it a good dressing of well-decayed manure, which is most effectively done by a second digging; the surface should then be raked over smoothly, so as to remove all stones and clods, thus reducing it to a fine tilth. The seed can then be sown in lines or patches as desired, the greatest care being taken not to cover deeply; a covering of not more than three times the diameter of larger seeds, and a light sprinkling of fine soil over small seeds, being all that is necessary. A slight mulching of well-decayed manure and a watering with a fine-rosed can will complete the operation. If the weather prove favourable, the young seedlings will usually make their appearance in a week or ten days; thin out so as to leave each plant (if in the border) at least 4 to 6 in. apart.

Orchard Notes for June.

THE COAST DISTRICTS.

The remarks that have appeared in these notes for the past two months apply in a great measure to June as well, as the advice that has been given regarding the handling, grading, packing, and marketing of the citrus crops still holds good. As the weather gets cooler the losses due to the ravages of fruit flies decrease, as these insects cannot stand cold weather, and consequently there is only an odd one about. The absence of flies does not, however, permit of any relaxation in the care that must be taken with the fruit, even though there may be many less injured fruit, owing to the absence of fruit-fly puncture, as there is always a percentage of damaged fruit which is liable to speck, which must be picked out from all consignments before they are sent to the Southern States, if a satisfactory return is to be expected. If the weather is dry, citrus orchards must be kept in a good state of tilth, otherwise the trees may get a setback. Old worn-out trees can be dug out and burnt; be sure, however, to see that they *are* worn out, as many an old and apparently useless tree can be brought round and made to bear good crops, provided the trunk and main roots are still sound, even though the top of the tree is more or less dead. The whole of the top of the tree should be cut off and only the trunk and such sound main limbs left as are required to make a new head. The earth should be taken away from around the collar of the tree, and the main roots exposed, any dead roots being cut away and removed. The whole of the tree above ground and the main roots should then be dressed with a strong lime sulphur wash, or Bordeaux paste. The main roots should be exposed for some time, not opened up and filled in at once. Young orchards can be set out now, provided the ground is in good order. Don't make the mistake of planting the trees in improperly prepared land—it is far better to wait till the land is ready, and you can rest assured it will pay to do so in the long run.

When planting, see that the centre of the hole is slightly higher than the sides, so that the roots, when spread out, will have a downward, not an upward, tendency; set the tree at as nearly as possible the same depth as it was when growing in the nursery, cut off all broken or bruised roots, and spread those that remain evenly, and cover them with fine top soil. If the land is dry, the tree should then be given a good watering, and when the water has soaked in, the hole can be filled up with dry soil. This is far better than watering the tree after the soil has been placed round it and the hole filled up. Custard apples will be ripening more slowly as the nights get colder, and if the weather becomes unduly cold, or if immature fruit is sent South, the fruit is apt to turn black and be of no value. This can easily be overcome by subjecting the fruit to artificial heat, as is done in the case of bananas.

during the cooler part of the year, when it will ripen up properly and develop its flavour. Grade custard apples carefully, and pack in cases holding a single layer of fruit only for the Southern markets.

Pineapples, when at all likely to be injured by frost, should be protected by a thin covering of bush hay, or similar material. The plantation should be kept well worked and free from weeds, and slow-acting manure, such as bone dust or island phosphates, can be applied now. Lime can also be applied when necessary. The fruit takes longer to mature at this time of the year, consequently it can be allowed to remain on the plant till partly coloured before gathering for the Southern markets, or can be fully coloured for local use.

Banana plantations must be kept worked and free from weeds, especially if the weather is dry, as a severe check to the plants now means small fruit later on. Bananas should be allowed to become full before the fruit is cut, as they will carry all right at this time of the year; in fact, there is more danger of their being injured by cold when passing through New England by train than there is of their ripening up too quickly.

Bear in mind the advice given with regard to the handling, grading, and packing of the fruit. It will pay you to do so. Land intended for planting with bananas or pinepaples during the spring should be got ready now.

Strawberries require constant attention, and unless there is a regular and abundant rainfall they should be watered regularly. In fact, in normal seasons, an adequate supply of water is essential, as the plants soon suffer from dry weather, or strong, cold westerly winds. Where not already done, vineyards should be cleaned up ready for pruning—it is, however, too early to prune or to plant out new vineyards.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

All kinds of deciduous fruit trees are now ready for pruning, and this is the principal work of the month in the orchards of the Granite Belt Area. Don't be frightened to thin out young trees properly, or to cut back hard—many good trees are ruined by insufficient or bad pruning during the first three years. If you do not know how to prune, do not touch your trees, but get practical advice and instructions from one or other of the Departmental officers stationed in the district. In old orchards do not have too much bearing wood; cut out severely, especially in the case of peaches, or you are likely to get a quantity of small unsaleable fruit. There are far too many useless and unprofitable fruit trees in the Granite Belt Area which are nothing more or less than breeding-grounds for pests, such as fruit fly, and are a menace to the district. Now is the time to get rid of them. If such trees are old and worn out, take them out and burn them, but if they are still vigorous, cut all the tops off and work them over with better varieties in the coming season—apples by grafting in spring and peaches and other stone fruits by budding on to young growth in summer. Planting can start now, where the land is ready and the trees are to hand, as early planted trees become well established before spring and thus get a good start. Be very careful what you plant. Stock to varieties of proved merit, and few at that, and give so-called novelties and inferior sorts a wide berth. Take the advice of old growers, and do not waste time experimenting with sorts that have probably been tested in the district, and turned down years ago. When land is intended for planting this season, see that it is well prepared and well sweetened before the trees are put in, as young trees seldom make a good start when planted in sour and badly prepared land.

Slowly acting manures—such as bonedust, meatworks manure, or island phosphates—can be applied now, as they are not liable to be washed out of the soil, and they will be available for the use of the trees when they start growth in spring. Lime can also be applied where required. Badly-drained land should be attended to, as no fruit trees will thrive with stagnant water lying round their roots.

On the Downs and Tableland all kinds of fruit trees can be pruned now, and vines can be pruned also in any district where there is no danger from late frosts, and where this can be done the prunings should be gathered and burnt and the vineyard ploughed up and well worked to reduce the soil to a good state of tilth, so that should rain come it will absorb all that falls and the moisture can be kept in the soil by cultivation subsequently.

Citrus fruits will be at their best in the Western districts. The trees should be watered if they show signs of distress, otherwise all that is necessary is to keep the surface of the land well worked. All main-crop lemons should be cut by this time, as if allowed to remain longer on the tree they only become overgrown and are more suitable for the manufacture of peel, whereas if cut and cased now they will keep in good order so that they can be used during the hot weather.

FORTHCOMING SHOWS.

The Queensland Chamber of Agricultural Societies has supplied the following list of show dates for 1924:—

Roma: 20th and 21st May.
Kilkivan: 21st and 22nd May.
Ipswich: 21st to 23rd May.
Emerald: 21st and 22nd May.
Beaudesert: 28th and 29th May.
Gayndah: 28th to 31st May.
Marburg: 2nd and 3rd June.
Hughenden: 3rd and 4th June.
Esk: 4th and 5th June.
Maryborough: 3rd to 6th June.
Childers: 10th and 11th June.
Bundaberg: 12th to 14th June.
Pine Rivers: 13th and 14th June.
Gin Gin: 16th and 18th June.
Woombye: 18th and 19th June.
Gladstone: 19th and 20th June.
Lowood: 20th and 21st June.
Mount Larcom: 21st June.
Rockhampton: 24th, 26th, 27th, and 28th June.
Mackay: 3rd to 5th July.
Kilcoy: 3rd and 4th July.
Biggenden: 3rd and 4th July.
Wallumbilla: 8th and 9th July.
Bowen: 9th and 10th July.
Laidley: 9th and 10th July.
Woodford: 10th and 11th July.
Gatton: 16th and 17th July.
Townsville: 16th and 17th July.
Caboolture: 17th and 18th July.
Sunnybank: 19th July.
Barcaldine: 22nd and 23rd July.
Charters Towers: 23rd and 24th July.
Rosewood: 23rd and 24th July.
Ithaca: 25th and 26th July.
Nambour: 30th and 31st July.
Ayr: 1st and 2nd August.
Mount Gravatt: 2nd August.
Humpybong: 7th August.
Royal National: 11th to 16th August.
Gympie: 20th and 21st August.
Belmont: 23rd August.
Imbil: 27th and 28th August.
Coorparoo: 30th August.
Crow's Nest: 4th September.
Wynnum: 6th September.
Beenleigh: 11th and 12th September.
Zillmere: 13th September.
Stephens: 20th September.
Rocklea: 27th September.
Kenilworth: 2nd October.
Toombul: 3rd and 4th October.
Southport: 10th October.

INSECT ATTACK ON STANDOVER COTTON.

A sample of one hundred green bolls three-quarters grown was taken recently from a standover crop in the Rockhampton district. These bolls were picked at random. The cotton was growing among the stumps and was not free of weeds.

The following figures are not without interest and give the results of the examination of the sample:—

No. of sound bolls, 27—

Attacked by maize grub (*Chloridea obsoleta*, Say.)	2
Attacked by peach grub (*Dichocrocis punctiferalis*, Guen)	15
Attacked by pink boll worm (*Platyedra gossypiella*, Saunders)	13
Attacked by boll rot apparently following on insect punctures	26
Attacked by boll rot punctures not seen	4
Attacked by boll rot just beginning	3
Unidentified insect attack	10
Total damaged from all causes	73

In every case of boll worm attack from any of the three species concerned, boll rot had set in, destroying two, three, or four locks. Some allowance must always be made for human error in sampling, but in the case of pink boll worm attack this does not apply, as no trace of attack can be seen until the boll is opened.—E. Ballard, Cotton Entomologist to the Commonwealth Government.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT WARWICK.

1924.	APRIL.		MAY.		JUNE.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	6·4	5·48	6·20	5·18	6·37	5·2
2	6 4	5·47	6 21	5·17	6·38	5·2
3	6 5	5·46	6·21	5·16	6 38	5·2
4	6·5	5 45	6 22	5·15	6·39	5 1
5	6 6	5·44	6 22	5·14	6·39	5·1
6	6·6	5 43	6·23	5·13	6·40	5·1
7	6 7	5 42	6 23	5·13	6·40	5·1
8	6·7	5 41	6 24	5·12	6·41	5·1
9	6 8	5·40	6·24	5 12	6·41	5·1
10	6·8	5·39	6 25	5·11	6·41	5·1
11	6 9	5·37	6 26	5·11	6 42	5 1
12	6 9	5·36	6 26	5·10	6·42	5·1
13	6·10	5 35	6·27	5·10	6·42	5·1
14	6·10	5·34	6·27	5·9	6·42	5 2
15	6·11	5 32	6·28	5·8	6·43	5·2
16	6·11	5 31	6·29	5·8	6·43	5·2
17	6 12	5 30	6·29	5·7	6 43	5 2
18	6 12	5·29	6·30	5·7	6·43	5·2
19	6 13	5·28	6·30	5·6	6·44	5 2
20	6·14	5·27	6 31	5·6	6·44	5·2
21	6·14	5 26	6 31	5·5	6 44	5 2
22	6·15	5 25	6·32	5·5	6·44	5 3
23	6·15	5 24	6 32	5·4	6 44	5·3
24	6·16	5 23	6·33	5 4	6·45	5·3
25	6 17	5·22	6 34	5·4	6·45	5·4
26	6·17	5 21	6·34	5 3	6·45	5 4
27	6·18	5·21	6·35	5·3	6 45	5·4
28	6 18	5·20	6 35	5·3	6·45	5·5
29	6·19	5·20	6 36	5·3	6 45	5·5
30	6·20	5·19	6·36	5·2	6·46	5 6
31	...	...	6·37	5·2	...	...

Phases of the Moon, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania, when "Summer" Time is not used.

4	Apr.	●	New Moon	5 17 p.m.
12	,,	☾	First Quarter	9 12 p.m.
20	,,	○	Full Moon	12 10 a.m.
26	,,	☽	Last Quarter	2 28 p.m.

Apogee 9th April, 1·12 a.m.
Perigee 21st April, 6·18 a.m.

On 8th April, between 2 and 3 p.m., the planet Venus will be very near the moon, on its left hand side. The moon will occult it by passing between the earth and the planet before 4 p.m. This should be an interesting spectacle, especially to those who have a telescope or binoculars; even without, the planet should be visible.

On 14th April, the moon will occult Regulus, the brightest star of Leo, between 6 and 7 p.m. The emergence of the planet soon after seven may be observed with binoculars.

The occultation of Uranus on the 29th, about 2 p.m., will be only visible in a telescope.

4	May	●	New Moon	9 0 a.m.
12	,,	☾	First Quarter	12 13 p.m.
19	,,	○	Full Moon	7 52 a.m.
26	,,	☽	Last Quarter	12 16 a.m.

Apogee 6th May, 12·0 noon.
Perigee 19th May, 3·18 p.m.

Regulus will again be occulted by the moon about 3 o'clock in the morning of the 13th of May.

The great astronomical event of May is the transit of Mercury, on the 8th, when the planet passing between the earth and the sun, will cross the sun's face from right to left, but in an upward direction. The commencement of the transit will be at 7·47 a.m. when the planet will reach the lower edge of the sun's disc. It's slow progress will continue until 3·35 p.m. when the sun's opposite limit will be considerably inclined over to the west.

Great care must be taken when attempting to look at the sun that the eyes are protected *very* carefully by *very* dark-coloured or smoked glass.

3	June	●	New Moon	12 33 a.m.
10	,,	☾	First Quarter	11 36 p.m.
17	,,	○	Full Moon	2 41 p.m.
24	,,	☽	Last Quarter	12 16 p.m.

Apogee 2nd June, 3·24 p.m.
Also Apogee 29th June, 9·24 p.m.
Perigee 17th June, 1·6 p.m.

The planet Mercury will be a morning star in June being at its greatest distance, west of the sun, on the 4th.

After Mercury being a morning star, Jupiter will be an evening star, rising, in the early part of the month, somewhere about the time of sunset.

Saturn being in conjunction with the moon on 12th of June, will appear about 2 p.m. on the left of the moon, but somewhat higher during the evening hours.

On 16th June, Mercury will be above the moon, distant about eight times its diameter, about 7 p.m.

On 22nd June, The Solstice, the sun, when having reached its furthest northern point in the sky, appears to stand still before turning southwards.

Saturn, on 30th June, will appear stationary, after which it will appear to be moving again east in its normal direction.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

[All the particulars on this page were computed for this Journal, and should not be reproduced without acknowledgment.]

CHEESE BOARD.

Department of Agriculture and Stock,
Brisbane, 15th May, 1924.

IN pursuance of the provisions of "*The Primary Products Pools Acts*, 1922 to 1923," notice is hereby given that it is the intention of the Lieutenant-Governor, acting as Deputy for and on behalf of his Excellency the Governor, in Council, upon the recommendation of the Council of Agriculture, to make the Order in Council set out in the Schedule hereto.

Dated this fifteenth day of May, 1924.

W. FORGAN SMITH.

SCHEDULE.

ORDER IN COUNCIL.

At the Executive Buildings, Brisbane, the day of , 1924.

Present:

The Lieutenant-Governor, acting as Deputy for and on behalf of His Excellency the Governor, in Council.

CHEESE BOARD.

WHEREAS by "*The Primary Products Pools Act of* 1922" it is amongst other things provided that the Governor in Council, upon the recommendation of the Council of Agriculture, may from time to time, or if requested so to do by a petition signed by a representative number of growers of any particular commodity or by an organisation representing the growers of that commodity, by Order in Council, declare that any grain, cereal, fruit, vegetable, or other product of the soil in Queensland, or any dairy produce (including butter and cheese) and eggs or any article of commerce prepared other than by any process of manufacture from the produce of agricultural or other rural occupations in Queensland, is and shall be a commodity under and for the purposes of that Act; and may by the same or a subsequent Order in Council constitute a Board in relation to the commodity so declared, and extend the provisions of that Act, either wholly or with all such modifications thereof or additions thereto as are deemed by him necessary to meet the particular circumstances, to such commodity and the Board so constituted, and all persons, things, and matters concerned; and that by any such Order in Council the classes of persons who shall be deemed to be growers of such commodity and the method of choosing the representatives of such growers may be declared: Now, therefore, the Lieutenant-Governor, acting as Deputy for and on behalf of His Excellency the Governor, and with the advice of the Executive Council, upon the recommendation of the Council of Agriculture, doth hereby order and declare that—

1. Cheese produced in Queensland is and shall be a commodity under and for the purposes of the above-mentioned Act, from the First day of July, 1924, until and including the Thirtieth day of June, 1927.

2. There is hereby constituted a Board, consisting of five members together with a person to represent the Council of Agriculture, in relation to such commodity.

3. The provisions of the said Act, with the following modifications and additions, are hereby extended to such commodity and the Board so constituted and all persons, things, and matters concerned—

(*a*) With the addition of the following provision:—

I.—Notwithstanding anything in this Act contained, the Minister, upon the recommendation of the Board, may from time to time direct, by notification in the *Gazette*, that no person shall deliver any cheese to the Board before a date mentioned in such notification. Thereupon the following consequences shall ensue until the date mentioned in such notification, that is to say:—

(i.) On Monday in every week—

(*a*) Every producer shall deliver to the Board a return in the prescribed form showing the total quantities of each description of cheese manufactured by him during the last preceding seven days, and the names and addresses of all persons to whom any cheese was during such period delivered or consigned by such producer for sale, and the respective quantities of the cheese so delivered or consigned to each such person and the respective descriptions thereof;

(*b*) Every agent for the sale of cheese shall deliver to the Board a return in the prescribed form showing the respective quantities of each description of cheese sold or agreed to be sold by him on behalf of any person during the last preceding seven days, and the price realised or agreed to be paid in respect of such respective quantities of cheese, and the names and addresses of the persons on whose behalf such respective quantities of cheese were sold or agreed to be sold, and such further particulars relating to such sales as the Board may from time to time require.

(ii.) If the Board is satisfied that any producer has sold in Queensland more cheese than his quota as determined by the Board, the Board may, by written notice in the prescribed form addressed to such producer, direct that such producer shall purchase cheese of the grade or description and in the respective quantities specified in such notice from such person and at such place and within such time as shall be specified in such notice: Provided that such last-mentioned person is willing to sell such cheese at the wholesale price of cheese of such grade or description then prevailing in such place. Any statement in such notice as to such wholesale price shall be *primâ facie* evidence of such price.

Any producer who fails to comply with any such direction of the Board shall pay to the Board a sum equal to the value of the cheese so directed to be purchased by such producer and which he has failed to purchase as so directed. Such sum shall be a debt due to the Chairman of the Board, and may be recovered by him in any Court of competent jurisdiction by proceedings in his official name of "Chairman of the State Cheese Board," and shall be paid by him to the person from whom such purchase was so directed to be made, provided such last-mentioned person delivers such cheese to the Board or as directed by the Board to be disposed of to or for the benefit of the producer who failed to purchase the same as aforesaid.

(iii.) The Minister may from time to time appoint, by writing under his hand, any person or persons authorising him or them to inspect and take copies of any books, papers, vouchers, records, or other documents of any producer or agent of a producer for the purpose of ascertaining or verifying any of the particulars prescribed to be included in any return under this section by such producer or agent, and for that purpose authorising the person or persons so appointed to enter into or upon any office or premises of such producer or agent; such producer or agent shall provide all reasonable facilities for such entry, inspection, and copying; such producer or agent, and every officer, agent, or servant of such producer or agent, shall furnish to the person or persons so appointed all such information in the power of such producer or agent or officer, agent, or servant of such producer or agent, as the case may be, as may reasonably be requested of him.

II.—(*a*) Every merchant, person, firm, or company who or which is a wholesale dealer in cheese shall make application to the Minister for a license to trade in such cheese, giving such information as may be required to enable the Minister to determine the application for such license. The Minister, on the recommendation of the Board, may refuse to grant or may withhold any license, or may withdraw or suspend any such license, without assigning any reason therefor. Every grower, authorised agent, and licensed wholesale dealer shall forthwith, when requested by the Board, supply to the Board as soon as may be practicable any information concerning stocks of cheese held at any time, and shall also furnish on demand any other information concerning contracts for sale, prices fixed by such contracts, and other matters relating thereto, which the Board may require for the purpose of the administration of this Act or the Regulations made thereunder. And

(*b*) With the modification that paragraph (*d*) of subsection 1 of section 21 is hereby deleted, and the following is inserted in lieu thereof:—

"Ascertaining whether cheese is of merchantable quality, and prescribing a standard therefor, and for an increase or decrease in the price otherwise payable to any grower for any cheese delivered by him to the Board according to the extent to which such cheese is graded above or below ninety points by a State grading officer; and regulating the storage, package, marking, branding, grading, carriage, exporting, and delivery of cheese."

4. The persons who shall be deemed to be growers and eligible to vote at any referendum or election in connection with the said Board prior to the Thirtieth day of June, one thousand nine hundred and twenty-four, shall be—

(*a*) Persons, partnerships, firms, or bodies of persons, corporate or unincorporate, who at any time during the period from the first day of January, one thousand nine hundred and twenty-four, until the date of such referendum or election produced or produce cheese for sale;

(*b*) Dairy farmers who at any time during the period from the first day of January, one thousand nine hundred and twenty-four, until the date of such referendum or election supplied or supply milk to a cheese factory.

5. The persons entitled to vote at any subsequent referendum or election in connection with the said Board shall be—

(*a*) Persons, partnerships, firms, or bodies of persons, corporate or unincorporate, who at any time during the six months immediately prior to the date of such referendum or election produced or produce cheese for sale;

(*b*) Dairy farmers who at any time during the six months immediately prior to the date of such referendum or election supplied or supply milk to a cheese factory.

And the Honourable the Secretary for Agriculture and Stock is to give the necessary instructions herein accordingly.

Clerk of the Council.

NOTES.—1. Any petition for a Poll to decide whether the above Order shall be made must be signed by at least fifty cheese producers or dairy farmers supplying milk to a cheese factory, and must reach the Minister before the Twenty-fifth day of June, 1924.

2. To insure their names being on the roll of persons eligible to vote, dairy farmers who have supplied milk to a cheese factory at any time since the 1st January, 1924, are invited to send their names and addresses and factories supplied at once to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Department of Agriculture and Stock,
Brisbane, 15th May, 1924.

NOTIFICATION.

CHEESE BOARD.

NOMINATIONS will be received by the Under Secretary, Department of Agriculture and Stock, Brisbane, until noon on the Eleventh day of June, 1924, for the Election as Growers' Representatives on the Cheese Board.

Five such representatives are to be elected by growers as defined in the notice in the *Government Gazette* of the 17th May, 1924, a copy of which appears above.

Each nomination is to be signed by at least ten growers in accordance with the terms of the notice.

ERNEST G. E. SCRIVEN, Under Secretary,
Department of Agriculture and Stock, Brisbane.